WATER PLANT OPTIMIZATION STUDY

NORTH BAY WATER TREATMENT PLANT

JANUARY 1994

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Please note that some of the recommendations contained in this report may have already been completed at time of publication. For more information, please contact the local municipality, or the Water Resources Branch of the Ministry of Environment and Energy.

Note, all references to Ministry of the Environment in this report should read Ministry of Environment and Energy.

WATER PLANT OPTIMIZATION STUDY
NORTH BAY WATER TREATMENT PLANT

Summary of Findings and Recommendations

The optimization study of the North Bay Water Supply is the start to an ongoing documentation of the operation of the plant. The study is a review of present conditions with emphasis on determining an optimum treatment strategy for removal of particulate matter and improving the disinfection process. Outlined below is a summary of the findings and recommendations of this study.

1. To remove particulates, it will be necessary to provide additional unit processes including coagulation, flocculation and filtration.

2. To provide additional mixing for chlorination, installation of one of the following is required:

   i) Variable speed mixer
   ii) Channel jet mixing injection system
   iii) Introduce under and over baffling in the raw water channel

3. Provide operator training

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SECTION A - RAW WATER SOURCE

SECTION A. RAW WATER SOURCE

A.1 SOURCE

The City of North Bay derives its water supply from Trout Lake. Trout Lake is located on the east border of the City in east Ferris Township. The lake consists of two essentially separate bodies of water, Four Mile Bay and Trout Lake, divided by a shallow constriction.Trout Lake drains in the east to Turtle Lake and Talon Lake through the Mattawa river system and then to the Ottawa River. The water level in Trout Lake is controlled at the outlet from Turtle Lake by an existing dam. The total drainage area of Trout Lake is approximately 179 sq.km.

Water is drawn from the lake through 300 metres of 1200 millimetre pipe. The only other major consumer of water from Trout Lake is the Department of National Defence operating the Semi Automatic Ground Environment (SAGE) complex. Several years ago the draw from Trout Lake by this complex was in the order of 100 l/s. This was used for cooling purposes and with the cooling water pumped back to the lake, actual consumption was in the order of 2-3 l/s.

In 1966 Proctor & Redfern reported that there was approximately 1.6 m^3/s contributed from the drainage area to Trout Lake. It was further stated in that report that this rate was not constant nor a mean flow from one year to the next but merely the average rate over a number of years.

A.2 QUALITY PARAMETERS

a) **Physical**

Over the three year study program it was observed that the raw water turbidity fluctuated from a low of 0.34 FTU to a high of 18.0 FTU. Normally the raw water turbidity levels are between 0.60 to 1.4 FTU, compared with the Ministry of the Environment Drinking Water Guidelines of a maximum allowable treated water turbidity of 1.0 F.T.U.

The raw water colour varied from 2.9 to 73.5 TCU during the period 1982 to 1985 and the treated water colour varied between 5.0 to 41.0 TCU over the same time period.

Due to the depth of the intake, raw water temperature does not fluctuate beyond $1^{o}C$ to $7^{o}C$.

b) <u>General Chemistry</u>

i) <u>Raw Water</u>

The raw water alkalinity and hardness are low and affect the Langelier Index relating to the corrosiveness of the water. Raw water alkalinity varies between 10.4 and 14.0 mg/L as $CaCO_3$ and hardness between 20.3 to 22.8 mg/L.The raw water pH varies between 6.85 to 7.8.

ii) <u>Treated Water</u>

These raw water parameters lead to a low Langelier Index in the order of - 2.8 to - 1.7. Treated water aggression indices from 1983 have been improved by introduction of sodium carbonate as follows:

Parameter	**Range**
pH	7.6 to 8.1
Alkalinity	17.8 to 28.8
Hardness	20.3 to 25.7
Langelier Index	-1.8 to - 1.0

In 1982, a study conducted by the Ministry of Environment showed some elevated lead levels from samples taken in the distribution system. These lead

levels were above the drinking water objective of .05 mg/L and ranged from 0.14 to 0.46 mg/L.

This problems was attributed to the corrosiveness of the raw water on old lead house services. At present the treated water lead levels after the addition of sodium carbonate are in the order of 0.005 to 0.01 mg/l.

c) **Bacteriological Parameters**

In November of 1986, high levels of fecal and total coliforms were measured in the raw water. Fecal coliform levels at that time were measured in the order of 4.0 per 100 mL and total coliforms as high as 96.0 per 100 mL. As a result of these high levels, chlorine residuals leaving the plant were increased from 0.6 mg/L to 1.0 mg/L. Further, a manual rechlorination system was put into service at the Birch's Road Standpipe.

The rechlorination system was incorporated into the system due to the high coliform counts. The coliform was identified as Klebsiella which may be associated with coliform regrowth in the water distribution system. Klebsiella have been reported to be problematic in water distribution systems where this group of coliform may become established in the sediments as a result of:

- inadequate source water protection
- unsatisfactory treatments protocols
- changes in the integrity of the pipe environment.

It is important to note that Klebsiella may be attributed to human and animal wastes (fecal origin) or environmental sources such as vegetation and to farm produce (non fecal origin).

During a site visit to the Trout Lake Pumping Station facilities, it was observed that fishing huts were present on the frozen lake and appeared to be close to the intake. More residential housing activity has also been located on the north east shore of Trout Lake, where neither city water nor sanitary services are available.

It is understood that a separate study has been undertaken by the Conservation Authority to review water quality and quantity within the Trout Lake watershed, and to address the overall question of source protection.

SECTION B FLOW MEASUREMENT

SECTION B. FLOW MEASUREMENT

B.1 TREATED

Flow at the Trout Lake Pumping Station is measured by a Venturi tube located in the pump discharge header.

The following data is available on the flow element:

Flow Element	Differential	Scale
DIN standard	0-320 inches	0-100,000 m^3/d
Throat 366mm	(8.128 m)	(0-22 MIGD)
Inlet 750mm		

No specific data is available on a minimum flow capability, although a range of 25 000 to 100 000 m^3/day would be considered conservative.

B.2 VALIDITY

The venturi and the transmitter is checked on a semi annual basis for accuracy by an outside instrument contractor and every two months the transmitter has a zero and span check.

B.3 RECORDING

The flow is recorded on a strip chart recorder at the Trout Lake Pumping Station Control Room, and the charts are maintained at that location.

SECTION C - PROCESS COMPONENTS

SECTION C. PROCESS COMPONENTS

C.1 GENERAL

This section includes detailed information on the unit processes and systems incorporated in the Trout Lake facilities. This section also includes a series of photographs to illustrate the plant components and chemical feed systems. In addition, illustrative drawings are included in Appendix C.

The Trout Lake facilities include the following chemical treatment components:

- disinfection
- fluoridation
- pH adjustment

The chemical treatment facilities are housed in a building separate from the Trout Lake Pumping Station. The Pumping Station was originally placed in service in 1929, while the chemical building was completed in 1984.

C.2 PLANT DESIGN DATA

a) **Capacity**

The total station capacity is 115,900 m^3/d with all electrically driven pumps operating. All these ratings assume pumps are operating at the rated head of 83.8 m .

The firm capacity of the Trout Lake pumping station is 79,500 m^3/d with No. 3 pump out of service.

b) **Factors Affecting Capacity**

In a power failure the firm capacity is reduced to 17,500 m^3/d with only the No. 5 pump available to operate.

In 1986, the maximum daily flow was 42,700 m^3/day. The current facility therefore has considerable spare capacity. Additional storage and booster pumping capacity is being planned in the distribution system to meet expanding needs.

C.3 PROCESS COMPONENT INVENTORY

a) **Intake**

The intake is a 1,200 mm diameter series 45 polyethylene pipe which extends approximately 300 metres into Trout Lake. The intake was constructed in 1973 and includes an intake crib in approximately 21.5 metres of water (at low water level).

The intake crib has a 90 degree elbow terminating with a fiber reinforced plastic (FRP) cage. The elbow contains a 6 mm steel core and is completely encased in 4.75 mm F.R.P. on both faces to resist frazil ice formation.

At the shore the polyethylene intake pipe connects to a 1,200 mm diameter concrete pressure pipe. This pipe runs to an intake chamber and then to a junction chamber. At the junction chamber, a 900mm connection exists for possible future use. The intake then discharges into a 1.8m by 1.35m high reinforced concrete channel to the screen area located inside the Trout Lake pumping station.

b) **Screening**

The wet well channel contains two stainless steel mesh F.R.P. framed screens in series. The screens have 6 mm mesh and a total gross area of $6.4m^2$. The screens consist of two panels stacked six high. The bottom 2 panels have been blocked off in order to promote raw water flow up and over the top of the blanked off areas and provide better mixing with the chlorine and fluoride. These are dosed immediately downstream of the screen.

Based on a net area of 4.0 m^2 the velocities through the screens range from a minimum of 0.07 m/s (at 22,725 m^3/d) to a maximum of 0.36 m/s (at 115,900 m^3/d). This corresponds to a minimum flow with either pump No. 1 or No. 4 operating up to maximum flow with all pumps operating. The latter situation has never occurred.

c) **Raw Water Well**

The raw water well connects the intake to the suction side of the pumping units. The suction connections for each high lift pump are connected directly to the well.

The total volume of raw water in the well fluctuates based on lake level, as follows:

Lake Level (m)	Volume (m^3)	Remarks
202.600	130	High lake level
202.000	107	Normal
201.780	99	Low lake level

d) **Treated Water Storage**

Treated water is pumped to the distribution system, which incorporates the following storage and pumping facilities:

Zone	Low. Contour	High Contour	Pumping Stations	Reservoirs Name	T.W.L.
1	212 m (695 ft)	241 m (790 ft)	Trout Lake	City Reservoir	275.8 m (905 ft)
1A	198 m (650 ft)	212 m (695 ft)	From Zone 1	Birch's Road Standpipe	249.9 m (820 ft)
2	271 m (890 ft)	300 m (985 ft)	Cannadore Station	None	-
3	300 m (985 ft)	328 m (1,075 ft)	High Lift Pumping Station	Base Reservoir/ 'B' Line Road Standpipe (Proposed)	361.7 m (1186.6 ft)
4	328 m (1,075 ft)	361 m (1,185 ft)	Zone 4 Pumping Station (proposed)	None	-

e) **High Lift Pumping**

The current ratings for the pumping units located at Trout Lake are as follows:

Pump No.	Capacity l/s	Head m	Type	Manufacturer
1	263	83.9	Vertical Double Suction	DeLaval
2	395	83.9	Vertical Double Suction	DeLaval
3	420	83.9	Vertical Double Suction	Ingersoll Rand
4	263	83.9	Vertical Double Suction	DeLaval
5	202	83.9	Horizontal Double Suction	DeLaval

Presently the installed capacity is 115,900 m^3/d (1,341 l/s) with a firm station capacity (No. 3 pump out of service) of 79,600 m^3/d (921 l/s). All pumps are electric motor driven, except No.5 which is a diesel driven unit. Pumps No. 1 and 4 operate during low demand, with No 2 or 3 being used for peak demands.

C.4 CHEMICAL SYSTEMS

The following is a list of chemicals that are presently being used at the Trout Lake station:

Chemical	Composition	Application	Control
Sodium Hypochlorite($NaOCl$)	12 percent available Chlorine (liquid)	pre-chlorination after screening	flow paced
Hydrofluosilicic Acid (H_2SiF_6)	79.8% with 25.0% available as fluoride	after screening	flow paced
Sodium Carbonate	dry powder mixed with warm water to 15% solution	Discharge main valve chamber outside pumping station	flow paced

a) Disinfection

Liquid sodium hypochlorite is stored in a separate chemical building on the Trout Lake pumping station site. The disinfectant is delivered to the site in bulk liquid tanker trailers and stored in two polyethylene tanks each measuring 2.44 m in diameter and 2.29 m high and with a capacity of 10,000 litres. Two sodium hypochlorite metering pumps located in the chemical building pump the solution to the wet well just downstream of the screens. These pumps are rated as follows:

	Min.	Max.	Manufacturer
Duty Pump	200 l/d	1,200 l/d	Wallace & Tiernan
Standby Pump	200 l/d	1,200 l/d	Wallace & Tiernan

b) **Fluoridation**

Hydrofluosilicic acid for fluoridation is stored in the same building as the sodium hypochlorite. The two chemicals are separated by a reinforced concrete wall and cannot therefore intermix in the event of a failure of storage vessels. The hydrofluosilicic acid is delivered to site in bulk liquid tanker trailers and stored in two polyethylene tanks measuring 2.44 m in diameter by 2.29 m high. Each vessel has a nominal capacity of 10,000 litres.

Hydrofluosilicic acid is transferred by a pumping system to two polyethylene day tanks situated on weigh scales at the pumping station. Each day tank is 0.915 m in diameter and 1.42 m high and has a nominal capacity of 900 litres.

Two Hydrofluosilicic acid metering pumps are located in the pumping station and pump the solution to the wet well just downstream of the screens adjacent to the chlorination point. The pumps are rated as follows:

	Min.	Max.	Manufacturer
Duty Pump	50 l/d	450 l/d	Wallace & Tiernan
Standby Pump	50 l/d	450 l/d	Wallace & Tiernan

c) **pH Adjustment**

Sodium carbonate (soda ash) is delivered in 25 Kg bags on pallets to the chemical building. The sodium carbonate is then mixed with warm water in two reinforced concrete holding tanks to form a 15 percent solution. Each holding

tank is 2.5 m high by 2.75 m wide and 2.75 m long and has a nominal capacity of 19,000 litres.

Sodium carbonate solution is pumped to a valve chamber just south of the chemical building, and injected into the 750 mm pumping station discharge main. The metering pumps are rated as follows:

	Min.	Max.	Manufacturer
Duty Pump	600 l/d	5700 l/d	Wallace & Tiernan
Standby Pump	600 l/d	5700 l/d	Wallace & Tiernan

C.5 SAMPLING

Full Drinking Water Surveillance Programme (DWSP) sampling is carried out on the raw water, prior to the screens, and on the treated water leaving the pumping station. These samples are collected via stainless steel sampling lines which are linked to the laboratory.

C.6 PROCESS AUTOMATION

The Trout Lake pumping station is equipped with hardwired controls for the main pumping units. The controls are located in the office/control room, along with telemetry and controls for other pumping stations, reservoirs, standpipes and valve chambers in the water distribution system. Alarm monitoring of sewage pumping stations located in the City is also undertaken at Trout Lake.

Continuous monitoring and recording of the following station parameters is also provided;

- raw water turbidity
- free chlorine residual
- treated water pH
- station flow

C.7 STANDBY POWER

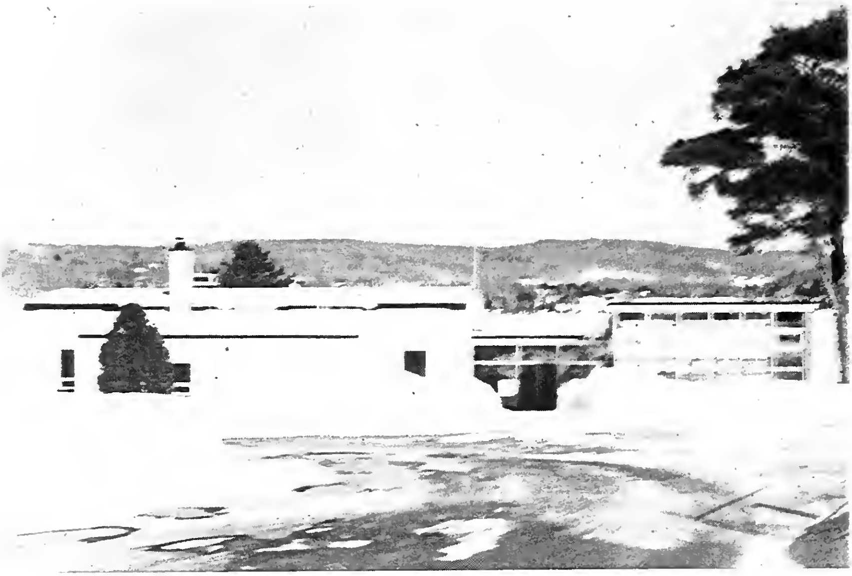
In the event of a power failure, supply can be maintained using the diesel engine driven Pump No. 5, which is manually started. No other sources of emergency power are available.

C.8 ILLUSTRATIONS

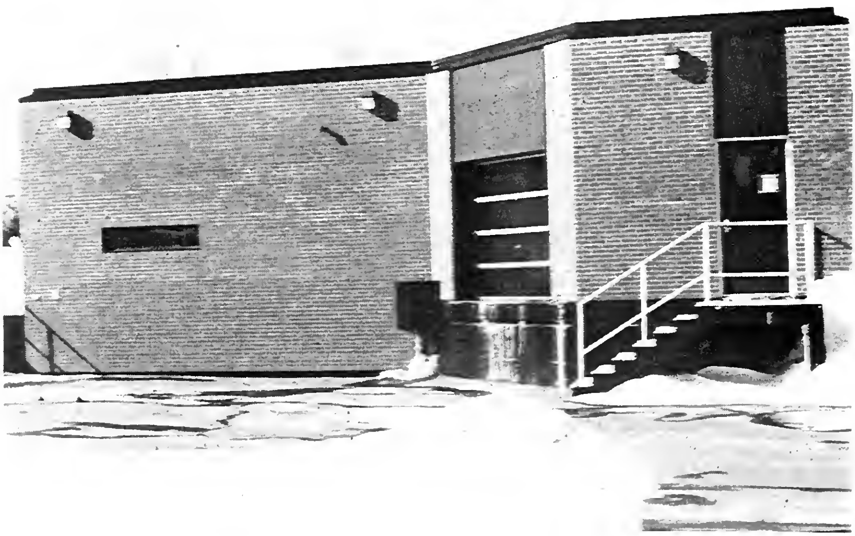
The following drawings are included in Appendix C:

- Trout Lake Plant Block Schematic
- Recommended Feeder Main, Reservoir and Pumping Station Improvements drawing

A series of photographs that illustrate the major plant components and chemical feed systems follow this section.



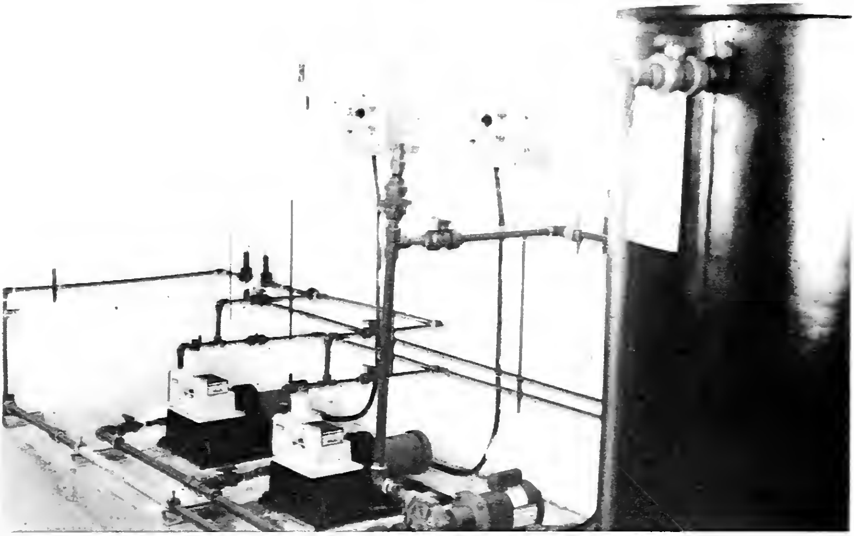
1. TROUT LAKE PUMPING STATION



2. CHEMICAL BUILDING

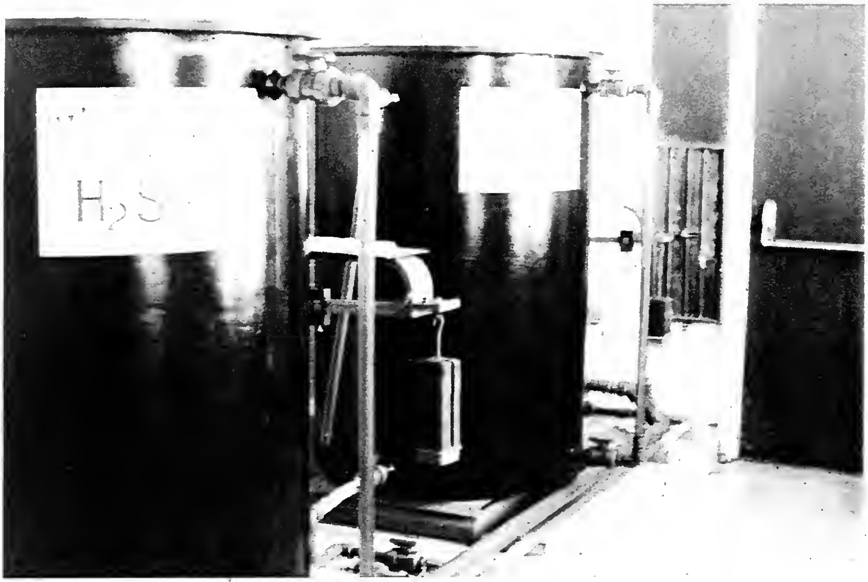
3. HIGH LIFT PUMPS (TROUT LAKE)

4. SODIUM CARBONATE MAKE-UP & FEED SYSTEM

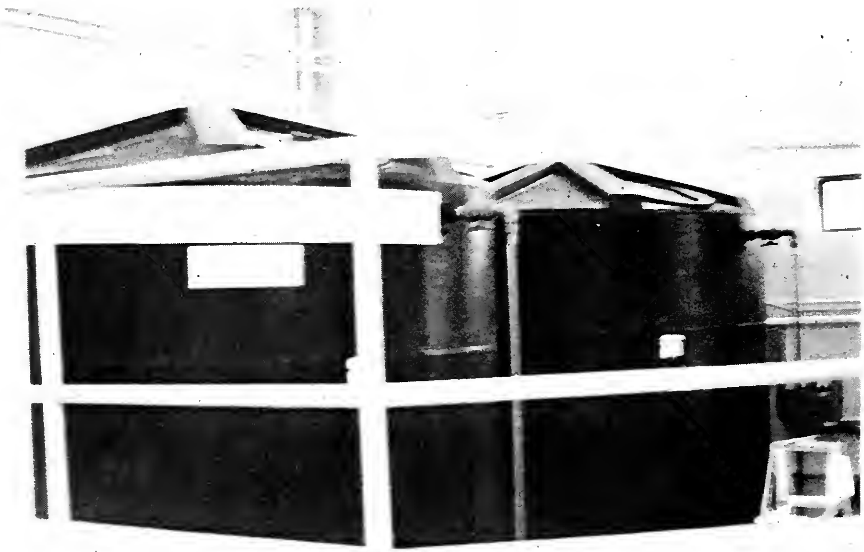


5. HYDROFLUOSILIC ACID FEED SYSTEM

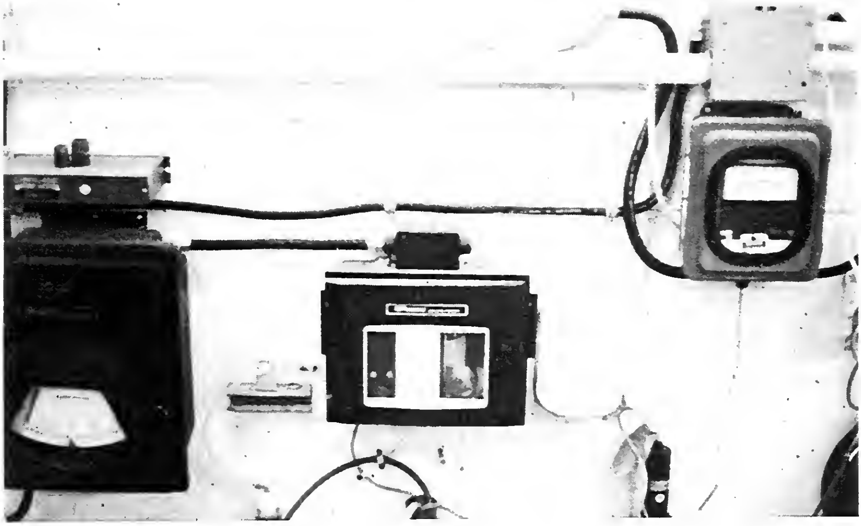
6. HYDROFLUOSILIC ACID BULK STORAGE



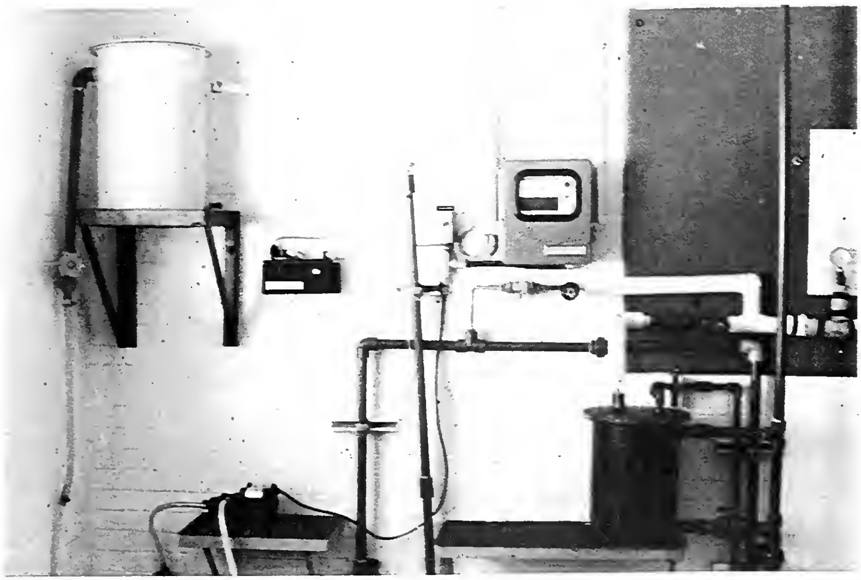
7. HYDROFLUOSILIC ACID DAY TANKS (ON WEIGH SCALES)



8. SODIUM HYPOCHLORITE BULK STORAGE

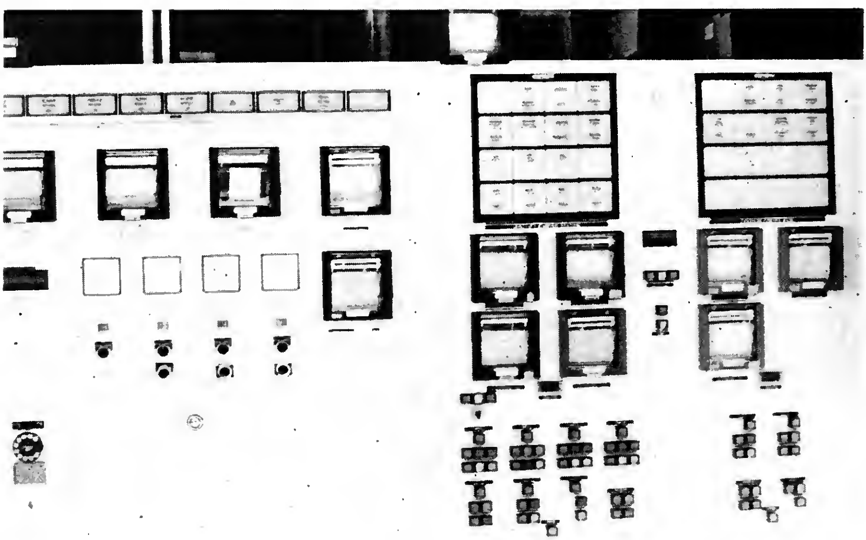


9. CHLORINE RESIDUAL ANALYZER



10. TURBIDITY SAMPLING, H_2SiF_6 AND NaOCl INJECTION SYSTEM

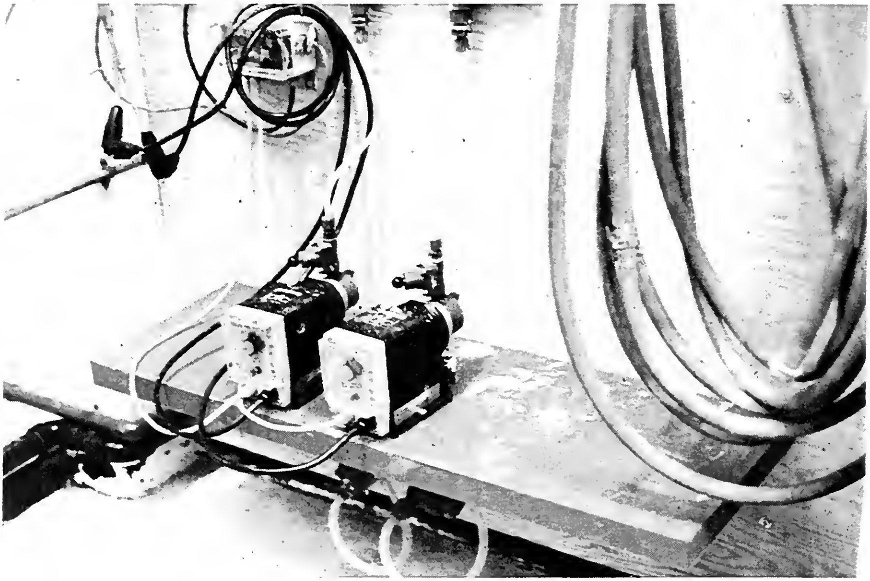
11. SCREEN WASH AREA



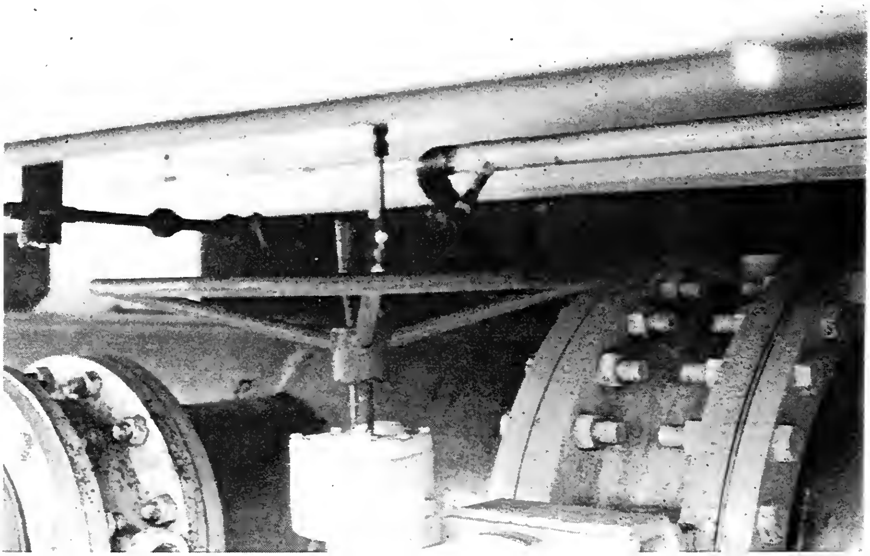
12. CONTROL PANEL

13. LABORATORY (TROUT LAKE)

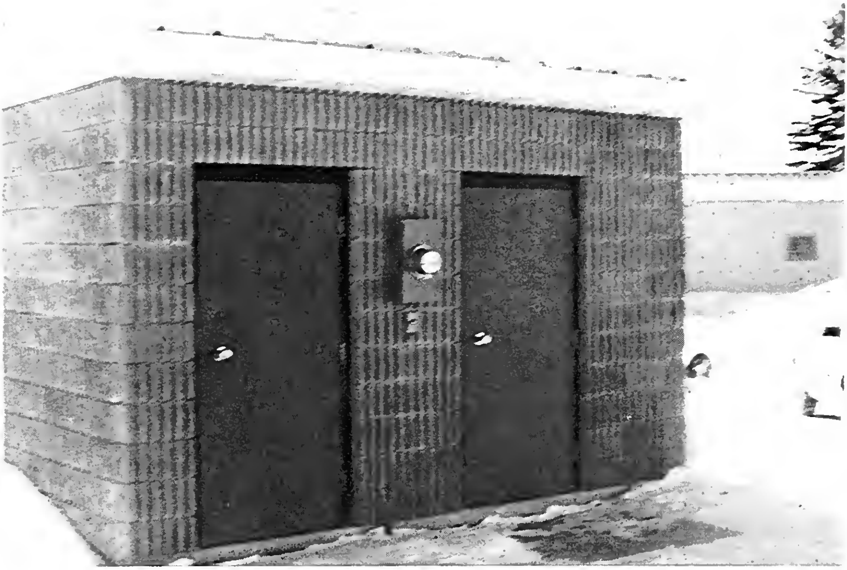
14. HIGHLEVEL RESERVOIR AND PUMPING STATION



15. SODIUM HYPOCHLORITE PUMPS (HIGH LIFT) - RECHLORINATION

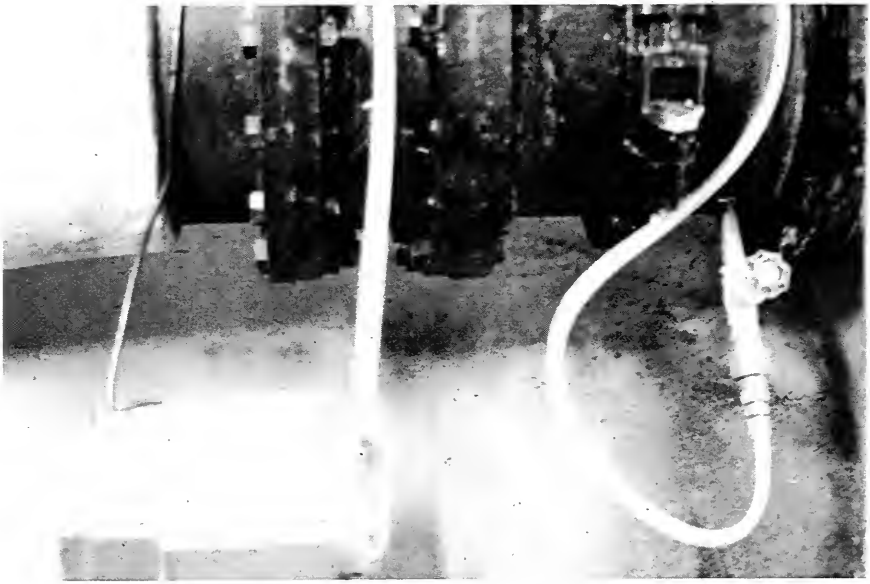


16. RECHLORINATION INJECTION POINT



17. JUDGE AVENUE VALVE HOUSE (FUTURE RECHLORINATION POINT)

18. BIRCH'S ROAD STANDPIPE VALVE CHAMBER
(TEMPORARY RECHLORINATION EQUIPMENT)



19. BIRCH'S ROAD VALVE CHAMBER (TEMPORARY CHLORINATION POINT)

SECTION D - PLANT OPERATION

SECTION D. PLANT OPERATION

D.1 GENERAL DESCRIPTION

The Trout Lake facility incorporates a raw water intake, a pumping station and chlorination, fluoridation and pH adjustment facilities. The system has a firm capacity of 79 500 m^3/day, compared with the maximum recorded flow of 42 700 m^3/day.

The pumping station is manned 24 hours a day, with one operator in attendance at all times. During the day, the chief operator is present, and all routine maintenance is performed during this time.

D.2 FLOW CONTROL

The following is a concise overview of the control of the pumping units at Trout Lake.

The pumping units are manually controlled and turned on and off by the plant personnel based on:

- level in the High Level Reservoir
- peak power demand

From Monday to Friday, all of the pumping units are turned off between the hours of 4:00 to 8:00 p.m. in order to save power demand charges. On Saturday and Sunday, usually pump No. 1 or No. 4 during continuously. During the week, Pump No. 1 or No. 4 usually operates during low demand periods, with Pump No. 2 or No. 3 being used to supplement during the peak periods.

The pumps in the high level station are controlled automatically from the level at the Canadian Force Base Reservoir. Until 1986, these pumps were also operated from Trout Lake.

D.3 DISINFECTION PRACTICES

Recent increases in coliforms in Trout Lake and subsequently in the distribution system have required an increase in the free chlorine residual leaving the station from 0.6 to 1.0 mg/L. Also, a temporary rechlorination system at the Birch's Road standpipe has been recently implemented. The manual rechlorination system at the standpipe consists of adding 20 litres of sodium hypochlorite solution into the standpipe on Monday and Thursday when the standpipe water level drops to approximately 30 metres from a normal level of 34 m.

During the rechlorination activities and also due to the increase in chlorine residual, complaints of chlorine tastes in the water have been received.

Space for rechlorination facilities is available at the Judge Avenue control chamber. This facility contains a step control valve which is controlled from the Birches Road Tank.

Along with the chlorination at Trout Lake it was stated earlier that the hypochlorite metering pumps have electric stroke length positioners which can accept a free chlorine residual signal. However, due to the sample location and the wide variation in flow (summer to winter) the compound loop control was found to be slightly unstable. A more appropriate sample location may be closer to the station. An appropriate sample location will be addressed in keeping with the current mixing being provided to sodium hypochlorite and hydrofluosilicic acid.

Although the need for adequate disinfection, more automated or otherwise, may be proven necessary at the Trout Lake pumping station, it appears that the need for additional disinfectant should be addressed. It would appear that recent

increases in activities on Trout Lake may have increased the coliform count. Further, residential housing on the north east shore of the lake does not have municipal services.

All these activities suggest that a comprehensive plan for protection of Trout Lake be implemented as soon as possible. At this time, the increase in coliforms is being combatted by the increased chlorination dosage at Trout Lake, and the rechlorination procedures at the Birch's Road standpipe.

A concern that was registered by neighbours was the operation of the vacuum transport system for sodium carbonate. This system transmitted very high noise levels in the residential neighbourhood. The transfer by was therefore discontinued and manual loading is practised.

D.4 OPERATIONAL CONCERNS

A current potential maintenance problem identified by plant personnel is the sophistication of telemetry equipment recently installed at various pumping stations throughout the City. This equipment is modern electronic hardware equipped with customized software. Presently, plant personnel have no training in maintaining or repairing this equipment in the event of a failure.

During the study period, two of five operators at the plant had Ministry of the Environment operator training on basic surface water treatment.

During a site visit by the protocol team on November 17, 1986 a hazard which was identified was a roof draining into the raw water well. On investigation of this roof drain, it was discovered that although it appears to drain into the raw water well it actually drains back into the lake. This roof drain is located in the screening area of the plant near the wash down area.

D.5 CHEMICAL DOSAGE CONTROL

Several physical and chemical water quality characteristics are specifically sampled and monitored at the pumping station.

Several of these parameters are continuously sampled and monitored as listed below:

Parameter	Equipment	Locations	Type of Sampling
pH	Lisle-Metrix Model A72 pH meter	Plant Discharge near Valve Chamber	Continuous
Chlorine Residual	Wallace & Tiernan A773/A780	Plant Discharge near Valve Chamber	Continuous
Turbidity	Hach Model 1720	Treated Water Downstream of Screens	Continuous
Fluoride Ion	Hach DR-2	Treated Water Sample from Pumping Station Discharge header	Grab sample every eight hours

Sodium Hypochlorite, Hydrofluosilicic Acid and Sodium Carbonate solutions are flow paced from the plant discharge flow transmitter on a 4-20 mA signal. No compound loop control is being practised at the Trout Lake Station.

D.6 SAMPLING

The following sampling programme is carried out at North Bay.

- Every Monday and Thursday, about 10 samples are taken (total 20) randomly throughout the City. Chlorine and pH residuals are measured at the location, and a sample is sent to the Ministry of Health Laboratory in Orillia for bacteriological analysis.

- Once a week, approximately 4 additional samples are taken and tested for chloride.

- Once a month, 4 additional samples are taken from each quarter of the City and sent to the Ministry of the Environment Laboratory for chemical analysis.

- Every quarter (3 months), a City staff representative along with a Ministry of the Environment representative take 4 additional samples from sampling points throughout the City, plus 1 untreated sample from the wet well, and 1 additional sample from the pumphouse. These are sent to the M.O.E. laboratory in Toronto for analysis for heavy metals (and any other special analysis that may be required.)

- The City also participates in the Drinking Water Surveillance Programme (D.W.S.P.) approximately once a month 15 samples are taken at 22 Herman and 693 Copeland Streets. These samples follow the procedure outlined for the D.W.S.P. programme and are additional to those taken at the Pumping Station.

D.7. AUTOMATION

Most of the distribution system is automated with respect to pump, reservoir and valve operation except the Trout Lake pumping station. Discussions have taken

place in previous years regarding automating the Trout Lake pumping system based on the level at the High Level Reservoir. Control equipment could be installed to operate the Trout Lake pumping units taking into account reservoir level and peak power demand times.

SECTION E PLANT PERFORMANCE

SECTION E PLANT PERFORMANCE

E.1 TURBIDITY REMOVAL

a) **General**

Of all the characteristics which give an indication of poor water quality, turbidity is considered as one of the most important. It has been shown in many studies that the particulates responsible for turbidity can harbour bacteria and other hazardous material and shield them from disinfection. It is for this reason that water treatment in Ontario requires the effluent to have a turbidity of less than 1 NTU and preferably as low as possible. Seasonal variations in the turbidity of a raw water source impose requirements on a water treatment plant design in order for a plant to achieve year round effluent of low turbidity.

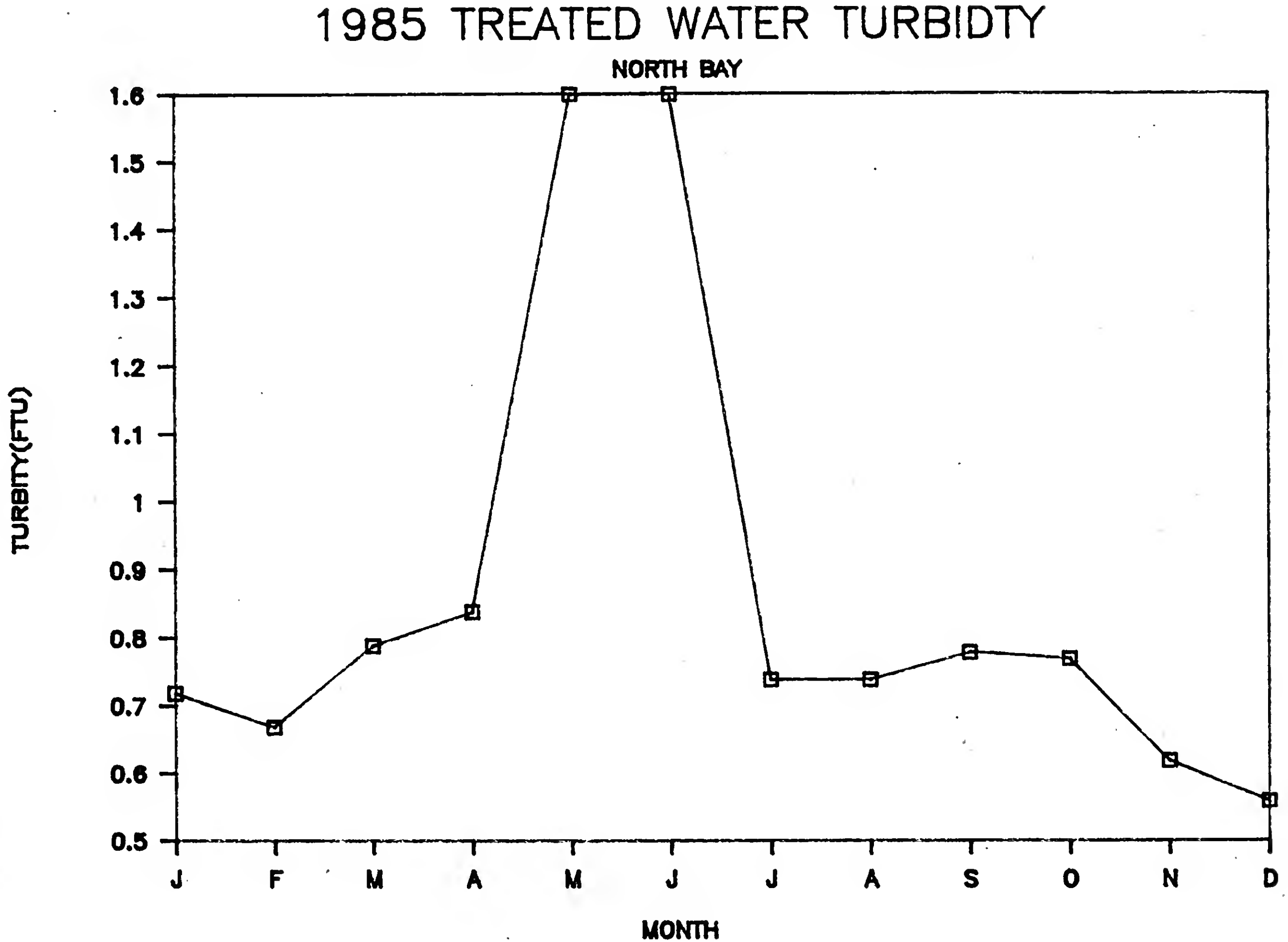
b) **Plant Performance**

The water from Trout Lake treated at the North Bay Water Treatment Plant currently undergoes chlorination, fluoridation and pH adjustment prior to discharge into the distribution system. Figure 4a, shows the seasonal variations in the turbidity levels of treated water into the distribution system. It can be seen that during spring and summer the treated water turbidity levels are higher than those recommended by the Ministry of the Environment level of 1.0 NTU.

The turbidity is monitored by a Lisle Metrix DRT200 turbidimeter on the treated water downstream of the screens on a continuous basis and recorded at the main control panel in the office. Calibration of the turbidimeter is carried out daily and there is no reason to believe that these results are inaccurate.

Since this plant has no facilities for particulate removal its efficiency of removal cannot be commented upon. The turbidity of the treated water entering the distribution system is generally just below the Ministry of Environment Maximum

FIGURE 4a


1985 TREATED WATER TURBIDTY
NORTH BAY
TURBITY(FTU)
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
J
F
M
A
M
J
J
A
S
O
N
D
MONTH

Acceptable Concentration (MAC) of 1.0 NTU and will periodically rise above this level.

c) <u>Treatability Testing</u>

Jar testing was carried out using the following procedure.

The jar testing was carried out using a 6- paddle stirrer and 1.5 Litre glass beakers.

Coagulant chemical was added while the water was stirred at 100 rpm. If required polymer was added after one minute. Following chemical addition the samples were allowed to stir for a further minute and thereafter for thirty minutes at 20 rpm.

The samples were then allowed to settle for a further 30 minutes and the supernatant decanted and filtered.

Testing of the raw water obtained at the intake of the North Bay treatment plant showed that the water can be adequately treated by coagulation and flocculation to reduce the turbidity to low levels. A tabulation of these tests are shown in Table 4.b.

The jar testing results can be summarized as follows:

- The use of aluminum sulphate alone gave effluent of acceptable colour and turbidity. Addition of 14 mg/L of aluminum sulphate gave a turbidity of 0.18 NTU from a raw water value of 0.25 NTU. The colour was also reduced well below the MOE's Maximum Acceptable Concentration (MDC) of 5 TCU. Since the raw water has a pH in the region of 6.9 the addition of alum reduces the pH of the water to the optimum pH range for flocculation.

TABLE 4B
TROUT LAKE - NORTH BAY
JAR TEST RESULTS*

	ALUM					
	1-C	1-2	1-3	1-4	1-5	1-6
COAGULENT DOSAGE (mg/l)	-	2	5	8	11	14
COAGULENT AID (mg/l)	-	-	-	-	-	-
pH	6.8	6.7	6.7	6.7	6.7	6.6
ALKALIN. (mg/l)	13.1	11.6	11.6	10.2	13.1	7
TURBIDITY (NTU)	0.25	0.33	0.41	0.38	0.35	0.18
COLOUR (TCU)	6.6	6.2	6.4	5	6	2.3
ALUM. RESIDUAL (mg/l) DIGESTED	0.04	0.16	0.43	0.12	0.7	0.07

	PAC					
	2-C	2-2	2-3	2-4	2-5	2-6
COAGULENT DOSAGE (mg/l)	-	8	11	14	20	30
COAGULENT AID (mg/l)	-	-	-	-	-	-
pH	7	7	6.9	6.8	6.9	6.6
ALKALIN. (mg/l)	13.8	13.8	10.9	12.3	8.7	10.2
TURBIDITY (NTU)	0.3	0.33	0.28	0.18	0.24	0.16
COLOUR (TCU)	6	6	4.6	3.7	3	2
ALUM. RESIDUAL (mg/l) DIGESTED						

	ALUM +PAC					
	3-C	3-2	3-3	3-4	3-5	3-6
COAGULENT DOSAGE (mg/l)	-	9	9	9	14	14
COAGULENT AID (mg/l)	-	5	7	9	3	7
pH	7.1	6.4	6.6	6.5	6.4	6.3
ALKALIN. (mg/l)	13.1	9.4	8.7	8.7	7.3	5.8
TURBIDITY (NTU)	0.3	0.21	0.23	0.15	0.2	0.16
COLOUR (TCU)	6.7	2.9	2.8	2.3	2.3	2
ALUM. RESIDUAL (mg/l) DIGESTED	0.05	0.05	0.04	0.04	0.03	0.06

	ALUM+ACIVATED SILICA					
	4-C	4-2	4-3	4-4	4-5	4-6
COAGULENT DOSAGE (mg/l)	-	5	5	5	10	10
COAGULENT AID (mg/l)	-	1	1.5	2	1	1.5
pH	6.9	8.8	8.9	9	8.7	8.9
ALKALIN. (mg/l)	13.8	35.5	46.4	56.6	33.3	43.5
TURBIDITY (NTU)	0.31	0.33	0.25	0.25	0.37	0.3
COLOUR (TCU)	6.7	7	6.8	6.9	7	7
ALUM. RESIDUAL (mg/l) DIGESTED						

	ALUM+LT22S					
	5-C	5-2	5-3	5-4	5-5	5-6
COAGULENT DOSAGE (mg/l)	-	5	5	10	10	10
COAGULENT AID (mg/l)	-	0.1	0.15	0.2	0.1	0.15
pH	6.8	6.6	6.6	6.9	6.4	6.5
ALKALIN. (mg/l)	13.0	11.6	12.3	10.2	8.7	8.7
TURBIDITY (NTU)	0.65	0.7	0.7	0.55	0.9	0.7
COLOUR (TCU)	6	6.4	5.7	5.4	3.2	6.1
ALUM. RESIDUAL (mg/l) DIGESTED						

	ALUM + LT27					
	6-C	6-2	6-3	6-4	6-5	6-6
COAGULENT DOSAGE (mg/l)	-	5	5	5	10	10
COAGULENT AID (mg/l)	-	0.1	0.15	0.2	0.1	0.15
pH	7	6.6	6.6	6.6	6.7	6.8
ALKALIN. (mg/l)	17.4	11.6	10.9	11.6	8.7	8.7
TURBIDITY (NTU)	0.5	0.95	0.91	0.83	0.64	0.38
COLOUR (TCU)	6	6.6	6.5	6.6	4.8	4.6
ALUM. RESIDUAL (mg/l) DIGESTED						

	ALUM					
	7-C	7-2	7-3	7-4	7-5	7-6
COAGULENT DOSAGE (mg/l)	-	10	15	20	25	30
COAGULENT AID (mg/l)	-	-	-	-	-	-
pH	6.8	6.4	6.2	5.9	5.8	5.3
ALKALIN. (mg/l)	14	7	7	4.5	3.5	3
TURBIDITY (NTU)						
COLOUR (TCU)	6.1	1.8	1	0.6	1.2	2.1
ALUM. RESIDUAL (mg/l) DIGESTED	0.03	0.06	0.08	0.11	0.22	0.6

*Jar Tests performed 87 09 15 to 87 09 22
Average Water Temperature - 20 C Except
Jar Test #7 @ 18 C

- Polyaluminum chloride, when used at a level of 14 mg/L or above, gives adequate removal of both turbidity and colour.

- Alum (9 mg/L) and polyaluminum chloride (5 mg/L) were shown to be very efficient in removing both colour and turbidity and gave very low aluminum residuals.

- Alum and activated silica were unsuccessful in removing turbidity and colour.

- Alum and Percol LT22S were unsuccessful in removing turbidity.

- Alum and Percol LT27 were unsuccessful in removing sufficient amounts of turbidity and colour.

From the jar test results it appears that a minimum of coagulation with aluminum sulphate along with filtration would provide treated water of adequate quality. However, taking into consideration the aluminum residual levels, it would be desirable to use aluminum sulphate and polyaluminum chloride together as coagulants for colour and turbidity removal. It is to be expected that pilot plant treatment trials would give a much better indication of the dosages of coagulant and type of treatment.

Such treatment involving coagulation and filtration would be required to achieve lower particulate levels in the treated water.

E.2 DISINFECTION PRACTICES

a) General

The chlorine residual in the water discharged from the plant is analyzed by a Wallace and Tiernan A773/A780 chlorine residual analyzer and recorded at the main control panel in the office.

b) Disinfection Efficiency

The incoming raw water from Trout Lake generally varies in colour from 2.9 to 73.5 TCU and the turbidity from 0.34 FTU to 18.0 FTU. The fecal and total coliform levels are generally within the MOE guidelines of 1 and 5 counts per 100 ml but occasionally rise above the guidelines.

The water leaving the plant has zero fecal coliforms and generally contains a free chlorine residual above 0.6 mg/L (See Figure 5a-d). due to a previous coliform outbreak in the distribution system which was attributed to Klebsiella, the chlorination levels were increased in an effort prevent such occurrences.

Turbidity can act as a source of protection for bacteria from chlorine. Unless the turbidity is further lowered, then such problems may reoccur.

c) Chlorinated By-Product Formation

The water from Trout Lake is generally high in colour. In combination with the current chlorination dosage the formation of halogenated organics would be expected. No data available from the Drinking Water Surveillance Programme shows the presence and nature of any halogenated organics in the treated water. The most efficient method of preventing the formation of halogenated organics would be to remove the colour and associated dissolved organic carbon by use of

a coagulant and filtration prior to chlorination. Of secondary value would be the implementation of powdered activated carbon or ozone in the process.

d) <u>Optimum Disinfection Process</u>

The recent outbreaks in Klebsiella are reported in the West Ferris area. In order to restrict the area of contamination the installation of chlorination facilities at the Judge Avenue station should be implemented. Chlorine residual analysis at this station should also be implemented.

The current mode of chlorinating the raw water is by pumping hypochlorite solution and dilution water to a tank and from this small vessel by gravity to the raw water channel. At high flow conditions, the flow through the screens allows proper mixing and dispersion of the disinfectant. However, under low flow conditions sufficient dispersion is not adequately achieved. Alternative means of providing additional mixing are:

- install a mixer of adequate size and manual variable speed capability to introduce sufficient turbulence.

- install a channel jet mixing injection system.

- introduce under and over baffling in the raw water channel.

FIGURE 5a

NORTH BAY

FREE CL2 RESIDUAL SUMMARY

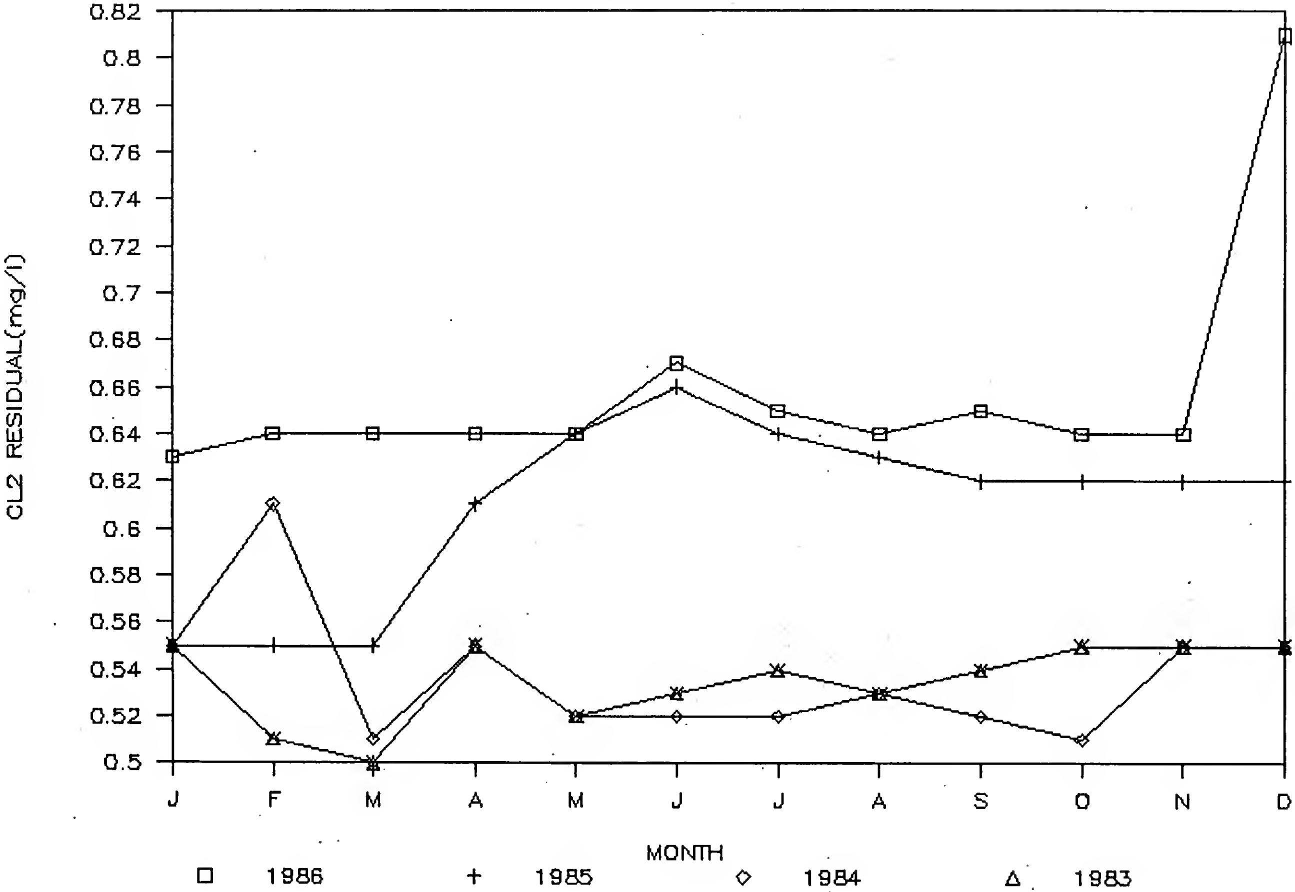


FIGURE 5b

NORTH BAY

FREE CL2 RESIDUAL SUMMARY

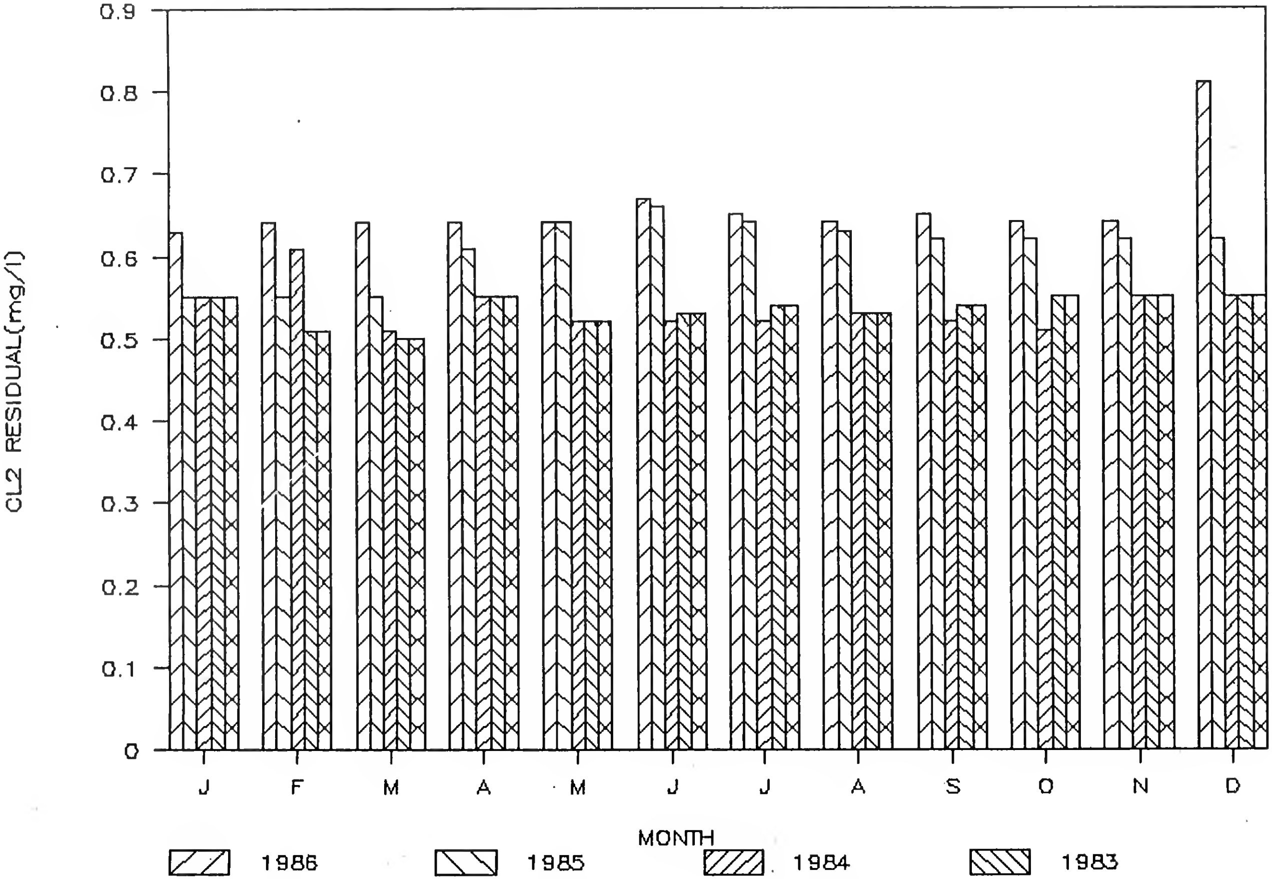


FIGURE 5c

NORTH BAY

TOTAL CL2 RESIDUAL SUMMARY

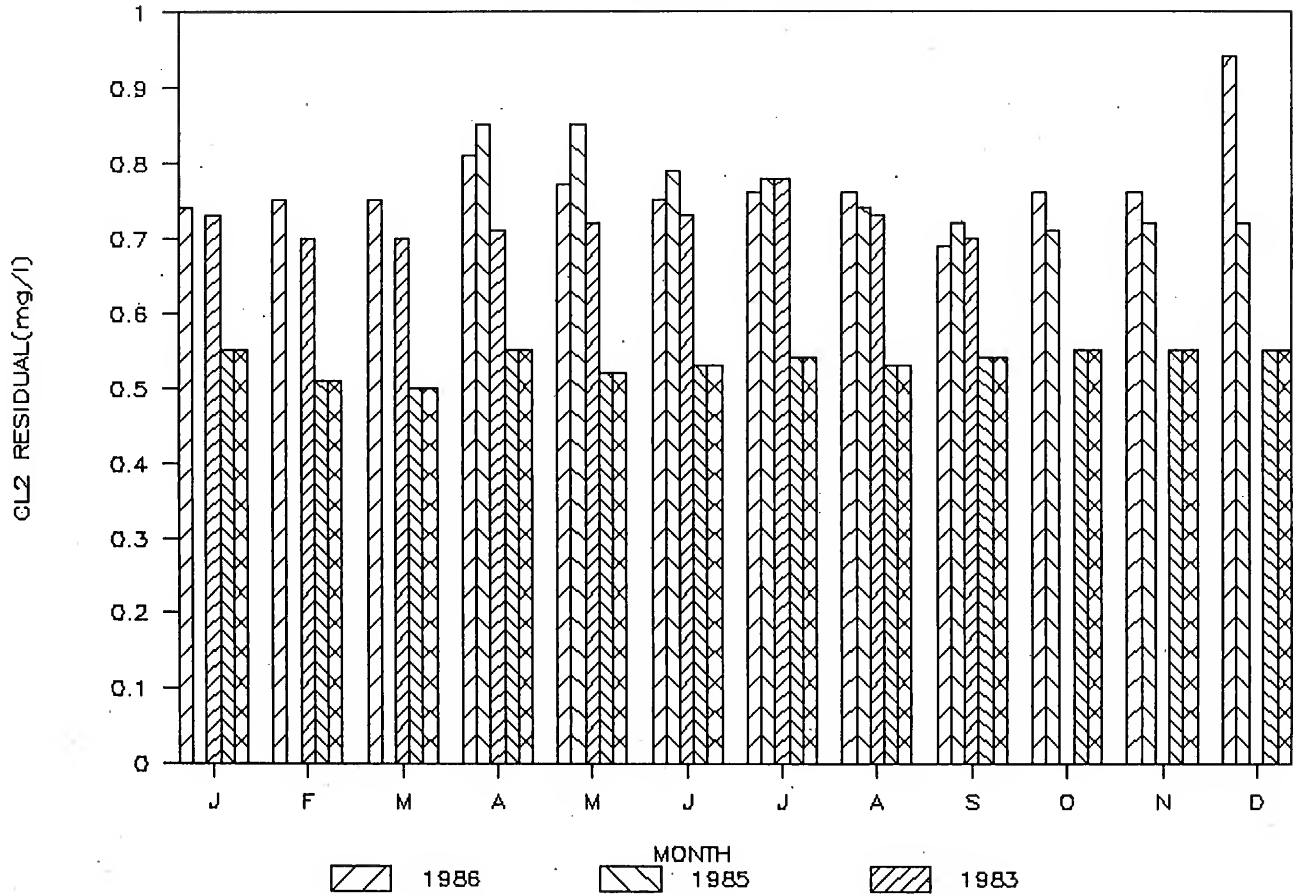
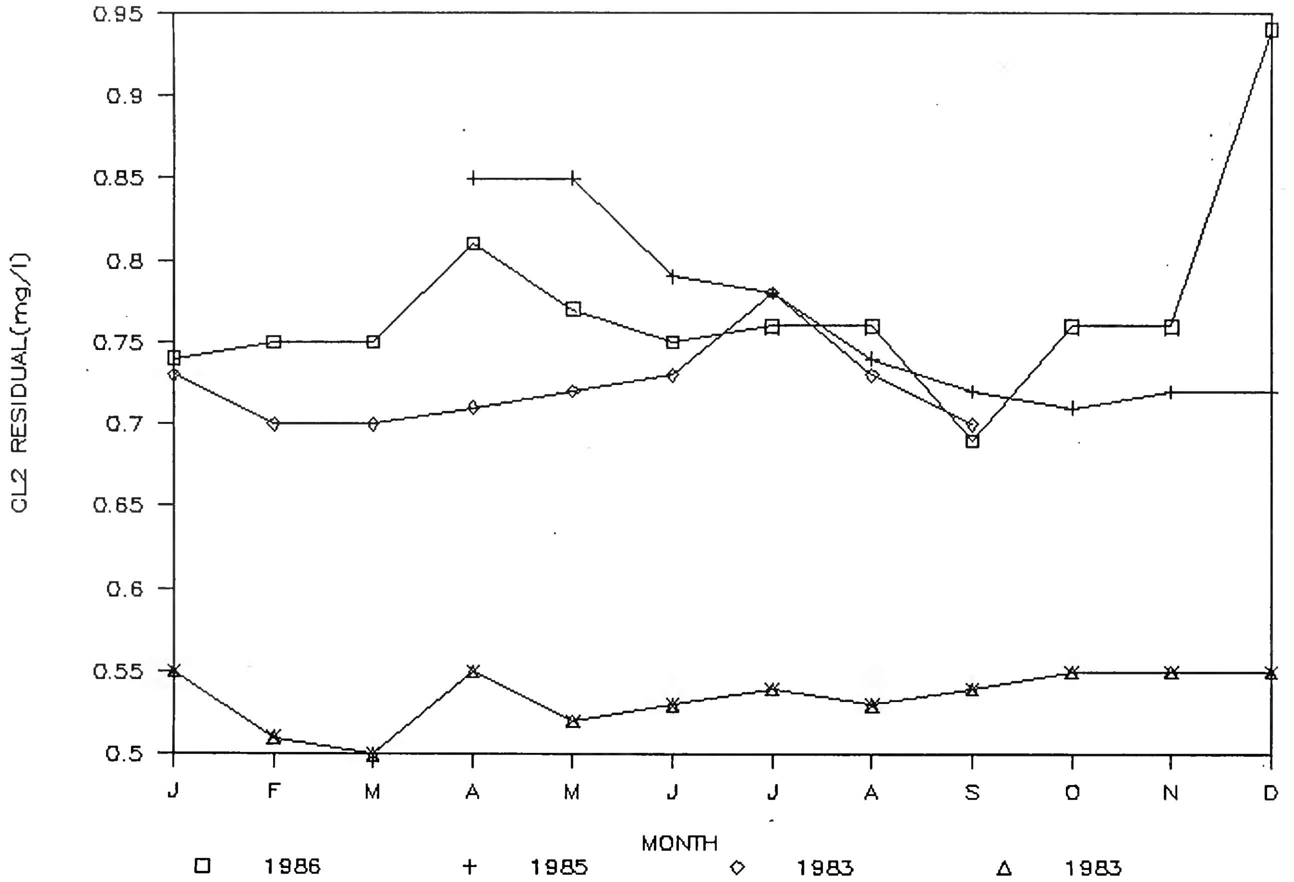


FIGURE 5d

NORTH BAY

TOTAL CL2 RESIDUAL SUMMARY



SECTION F SHORT TERM MODIFICATIONS

SECTION F. SHORT TERM MODIFICATIONS

F.1 SOURCE PROTECTION (PARTICULATES)

It is recommended that an investigation should be undertaken for the protection of the raw water and catchment area. Also, this should include the continuation of loading to Trout Lake and the identification of means of restricting activities in the vicinity of the existing intakes.

In addition, it is recommended that the city initiate a pilot study program to identify viable unit processes for particulate and colour removal.

F.2 DISINFECTION

The present method of disinfection is by chlorination. It is recommended that the design and implementation of rechlorination and monitoring facilities at the Judge Avenue Station be continued, as well as the monitoring other areas of the distribution system that may require remedial disinfection.

F.3 SYSTEM MODIFICATION

In addition to the above short term modifications, the following recommendations should be implemented.

- Provide operator training, including such topics as basic chlorination and water treatment principles.
- Initiate alternative means of providing additional mixing for dispersion of hypochlorite at low flow regimes.
- Re-instate compound loop chlorination control with a revised sampling location.

SECTION G LONG TERM MODIFICATIONS

SECTION G. LONG TERM MODIFICATIONS

G.1 DISINFECTION/PARTICULATES

It is recommended that pilot treatability studies be initiated on this water supply. These studies should investigate unit processes including rapid mixing, coagulation/flocculation, separation/sedimentation and filtration.

It should be recognized that many of the components at Trout Lake have been built with the flexibility to be incorporated into a future treatment plant. For example, the intake system can be diverted to flow to a new low lift pumping station, the present pumping station can still be utilized as a high lift and the chemical building has been constructed for ease of dosing various chemicals in the future.

The results of these studies, conducted on a full range of annual raw water conditions, would simplify the ultimate design of a water treatment plant, should it ever be required, and for satisfying the Ministry of the Environment policies for monitoring of surface water supplies.

APPENDIX A - TABLES

TROUT LAKE

TABLE 1.0: FLOWS (ML/d)

MOE WPOS PROTOCOL

		1986			1985			1984			1983		
		MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG
JAN	R	-	-	-	-	-	-	-	-	-	-	-	-
	T	27.39	21.62	24.62	27.78	22.72	23.57	24.42	19.91	21.48	22.58	19.17	21.91
FEB	R	-	-	-	-	-	-	-	-	-	-	-	-
	T	33.23	21.79	25.47	24.85	22.96	23.57	36.23	20.19	22.03	24.51	21.62	22.21
MAR	R	-	-	-	-	-	-	-	-	-	-	-	-
	T	26.94	22.29	24.59	27.82	21.02	23.61	25.67	18.80	20.86	22.60	16.71	19.36
APR	R	-	-	-	-	-	-	-	-	-	-	-	-
	T	34.53	22.47	25.37	25.48	20.80	23.20	23.77	18.43	20.81	19.08	16.15	18.44
MAY	R	-	-	-	-	-	-	-	-	-	-	-	-
	T	36.62	19.89	26.91	30.92	18.99	24.05	27.64	18.34	21.30	27.82	13.88	19.54
JUN	R	-	-	-	-	-	-	-	-	-	-	-	-
	T	36.34	22.61	26.14	40.17	19.49	26.33	32.39	17.81	23.64	49.25	18.81	28.00
JUL	R	-	-	-	-	-	-	-	-	-	-	-	-
	T	42.71	21.51	29.59	44.46	18.61	27.06	32.47	17.57	23.88	52.20	19.74	34.59
AUG	R	-	-	-	-	-	-	-	-	-	-	-	-
	T	37.19	22.30	28.00	30.93	22.23	25.99	31.73	20.35	24.43	40.17	20.41	27.22
SEP	R	-	-	-	-	-	-	-	-	-	-	-	-
	T	28.04	23.76	20.58	32.02	16.61	24.02	23.15	19.54	21.61	33.75	20.82	23.86
OCT	R	-	-	-	-	-	-	-	-	-	-	-	-
	T	27.77	23.38	25.58	26.38	20.61	22.71	28.27	20.02	22.65	31.04	17.32	22.26
NOV	R	-	-	-	-	-	-	-	-	-	-	-	-
	T	26.98	23.38	24.51	22.04	18.16	20.42	23.45	20.77	22.11	22.22	18.44	20.45
DEC	R	-	-	-	-	-	-	-	-	-	-	-	-
	T	28.17	20.58	25.69	25.65	20.03	22.29	23.38	21.11	22.80	29.85	18.78	21.10

Table 1.1: Per Capita Consumption (l/d/capita)

NORTH BAY

CONSUMPTION	1986	1985	1984
Population *	50,437	50,480	50,528
Maximum Day	847	881	717
Minimum Day	394	329	348
Average Day	508	474	441
Ratio MD:AD	1.67	1.86	1.62

* From Statistics Canada 1988, '84, '82 Municipal Directory

TABLE 2.0: PARTICULATE REMOVAL SUMMARY

MOE WPOS PROTOCOL

				1986			1985			1984			1983		
				MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AV
JAN	TURBIDITY (FTU)		R	-	-	-	-	-	-	-	-	-	-	-	-
			T	-	-	-	0.99	0.60	0.72	-	-	-	-	-	-
	Prime Coagulant	(mg/L)													
	Coagulant Aid	(mg/L)													
	Filter Aid	(mg/L)													
	Metal Res. Al/Fe	(mg/L)	R												
			T												
	pH		R	-	-	-	-	-	-	-	-	-	-	-	-
			T	-	-	-	9.0	6.9	7.9	-	-	-	-	-	-
	Temperature	(C)		3	2	2	2	2	2	5	1	4	3	2	
FEB	TURBIDITY (FTU)		R	-	-	-	-	-	-	-	-	-	-	-	-
			T	-	-	-	0.90	0.32	0.67	-	-	-	-	-	-
	Prime Coagulant	(mg/L)													
	Coagulant Aid	(mg/L)													
	Filter Aid	(mg/L)													
	Metal Res. Al/Fe	(mg/L)	R												
			T												
	pH		R	-	-	-	-	-	-	-	-	-	-	-	-
			T	-	-	-	8.1	7.2	8.0	-	-	-	-	-	-
	Temperature	(C)		3	3	3	2	2	2	6	2	4	2	2	
MAR	TURBIDITY (FTU)		R	-	-	-	-	-	-	-	-	-	-	-	-
			T	-	-	-	1.20	0.60	0.79	-	-	-	-	-	-
	Prime Coagulant	(mg/L)													
	Coagulant Aid	(mg/L)													
	Filter Aid	(mg/L)													
	Metal Res. Al/Fe	(mg/L)	R												
			T												
	pH		R	-	-	-	-	-	-	-	-	-	-	-	-
			T	-	-	-	8.1	7.2	7.7	-	-	-	-	-	-
	Temperature	(C)		3	2	2	4	2	2	4	2	3	2	1	
APR	TURBIDITY (FTU)		R	-	-	-	-	-	-	-	-	-	-	-	-
			T	-	-	-	1.50	0.45	0.84	-	-	-	-	-	-
	Prime Coagulant	(mg/L)													
	Coagulant Aid	(mg/L)													
	Filter Aid	(mg/L)													
	Metal Res. Al/Fe	(mg/L)	R												
			T												
	pH		R	-	-	-	-	-	-	-	-	-	-	-	-
			T	-	-	-	8.0	7.5	7.7	-	-	-	-	-	-
	Temperature	(C)		4	2	3	5	2	2	4	2	3	3	2	

TABLE 2.0 (cont'd)

MAY	TURBIDITY (FTU)	R	-	-	-	-	-	-	-	-	-	-	-	-
		T	-	-	-	2.10	0.90	1.60	-	-	-	-	-	-
	Prime Coagulant (mg/L)													
	Coagulant Aid (mg/L)													
	Filter Aid (mg/L)													
	Metal Res. Al/Fe (mg/L)	R												
		T												
	pH	R	-	-	-	-	-	-	-	-	-	-	-	-
		T	-	-	-	7.8	7.5	7.7	-	-	-	-	-	-
	Temperature (C)		6	3	5	5	3	4	6	4	5	6	3	4
JUN	TURBIDITY (FTU)	R	-	-	-	-	-	-	-	-	-	-	-	-
		T	-	-	-	2.40	1.00	1.60	-	-	-	-	-	-
	Prime Coagulant (mg/L)													
	Coagulant Aid (mg/L)													
	Filter Aid (mg/L)													
	Metal Res. Al/Fe (mg/L)	R												
		T												
	pH	R	-	-	-	-	-	-	-	-	-	-	-	-
		T	-	-	-	7.8	7.5	7.6	-	-	-	-	-	-
	Temperature (C)		6	5	6	8	4	6	7	6	6	6	6	6
JUL	TURBIDITY (FTU)	R	-	-	-	-	-	-	-	-	-	-	-	-
		T	-	-	-	1.10	0.10	0.74	-	-	-	-	-	-
	Prime Coagulant (mg/L)													
	Coagulant Aid (mg/L)													
	Filter Aid (mg/L)													
	Metal Res. Al/Fe (mg/L)	R												
		T												
	pH	R	-	-	-	-	-	-	-	-	-	-	-	-
		T	-	-	-	8.2	7.2	7.6	-	-	-	-	-	-
	Temperature (C)		6	6	6	9	7	7	7	7	7	6	6	6
AUG	TURBIDITY (FTU)	R	-	-	-	-	-	-	-	-	-	-	-	-
		T	-	-	-	0.80	0.60	0.74	-	-	-	-	-	-
	Prime Coagulant (mg/L)													
	Coagulant Aid (mg/L)													
	Filter Aid (mg/L)													
	Metal Res. Al/Fe (mg/L)	R												
		T												
	pH	R	-	-	-	-	-	-	-	-	-	-	-	-
		T	-	-	-	8.0	5.9	7.4	-	-	-	-	-	-
	Temperature (C)		7	6	6	7	7	7	7	7	7	7	6	6

TABLE 2.0 (cont'd)

SEP	TURBIDITY (FTU)	R	-	-	-	-	-	-	-	-	-	-	-
		T	-	-	-	0.80	0.70	0.78	-	-	-	-	-
	Prime Coagulant (mg/L)												
	Coagulant Aid (mg/L)												
	Filter Aid (mg/L)												
	Metal Res. Al/Fe (mg/L)	R											
		T											
	pH	R	-	-	-	-	-	-	-	-	-	-	-
		T	-	-	-	7.6	6.7	7.3	-	-	-	-	-
	Temperature (C)		7	6	6	7	6	7	8	7	7	6	6
OCT	TURBIDITY (FTU)	R	-	-	-	-	-	-	-	-	-	-	-
		T	-	-	-	0.80	0.68	0.77	-	-	-	-	-
	Prime Coagulant (mg/L)												
	Coagulant Aid (mg/L)												
	Filter Aid (mg/L)												
	Metal Res. Al/Fe (mg/L)	R											
		T											
	pH	R	-	-	-	-	-	-	-	-	-	-	-
		T	-	-	-	7.8	7.2	7.4	-	-	-	-	-
	Temperature (C)		7	6	6	8	7	7	8	7	7	9	6
NOV	TURBIDITY (FTU)	R	-	-	-	-	-	-	-	-	-	-	-
		T	-	-	-	0.72	0.00	0.62	-	-	-	-	-
	Prime Coagulant (mg/L)												
	Coagulant Aid (mg/L)												
	Filter Aid (mg/L)												
	Metal Res. Al/Fe (mg/L)	R											
		T											
	pH	R	-	-	-	-	-	-	-	-	-	-	-
		T	-	-	-	7.5	7.0	7.3	-	-	-	-	-
	Temperature (C)		7	2	4	9	3	6	8	4	6	8	3
DEC	TURBIDITY (FTU)	R	-	-	-	-	-	-	-	-	-	-	-
		T	-	-	-	0.68	0.00	0.56	-	-	-	-	-
	Prime Coagulant (mg/L)												
	Coagulant Aid (mg/L)												
	Filter Aid (mg/L)												
	Metal Res. Al/Fe (mg/L)	R											
		T											
	pH	R	-	-	-	-	-	-	-	-	-	-	-
		T	-	-	-	8.0	7.1	7.4	-	-	-	-	-
	Temperature (C)		2	2	2	3	2	2	4	1	3	3	2

TABLE 3.0: DISINFECTION SUMMARY : NORTH BAY

MOE WPOS PROTOCOL

		1986						1985						1984					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG
JAN	Cl2 Demand	-	-	-				-	-	-				-	-	-			
	Cl2 Dosage	1.80	1.52	1.67				1.58	1.32	1.42				1.6	0.95	1.18			
	Ammonia	-	-	-				-	-	-				-	-	-			
	SO2	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Free	0.69	0.59	0.63				0.55	0.55	0.55				0.55	0.55	0.55			
	Residual Cl2 Combined	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Total	0.80	0.70	0.74				-	-	-				-	-	-			
FEB	Cl2 Demand	-	-	-				-	-	-				-	-	-			
	Cl2 Dosage	1.73	1.50	1.65				1.60	1.30	1.48				1.43	1.10	1.27			
	Ammonia	-	-	-				-	-	-				-	-	-			
	SO2	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Free	0.68	0.61	0.64				0.60	0.55	0.55				1.26	0.50	0.61			
	Residual Cl2 Combined	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Total	0.79	0.70	0.75				-	-	-				-	-	-			
MAR	Cl2 Demand	-	-	-				-	-	-				-	-	-			
	Cl2 Dosage	2.02	1.54	1.63				1.65	1.31	1.52				0.16	0.96	1.29			
	Ammonia	-	-	-				-	-	-				-	-	-			
	SO2	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Free	0.70	0.58	0.64				0.60	0.55	0.55				0.55	0.45	0.51			
	Residual Cl2 Combined	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Total	0.82	0.67	0.75				-	-	-				-	-	-			
APR	Cl2 Demand	-	-	-				-	-	-				-	-	-			
	Cl2 Dosage	2.58	1.50	2.14				2.44	1.32	1.76				1.70	1.25	1.50			
	Ammonia	-	-	-				-	-	-				-	-	-			
	SO2	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Free	0.72	0.60	0.64				0.65	0.55	0.61				0.58	0.55	0.55			
	Residual Cl2 Combined	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Total	0.90	0.75	0.81				0.90	0.75	0.85				-	-	-			

TABLE 3.0 (cont'd)

		1986						1985						1984					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG
MAY	Cl2 Demand	-	-	-				-	-	-				-	-	-			
	Cl2 Dosage	1.98	1.49	1.69				2.03	1.42	1.70				1.56	1.30	1.45			
	Ammonia	-	-	-				-	-	-				-	-	-			
	SO2	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Free	0.68	0.61	0.64				0.65	0.60	0.64				0.55	0.50	0.52			
	Residual Cl2 Combined	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Total	0.82	0.71	0.77				0.95	0.65	0.85				-	-	-			
JUN	Cl2 Demand	-	-	-				-	-	-				-	-	-			
	Cl2 Dosage	1.82	1.45	1.65				2.18	1.50	1.70				1.72	1.16	1.47			
	Ammonia	-	-	-				-	-	-				-	-	-			
	SO2	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Free	0.80	0.62	0.67				0.70	0.62	0.66				0.55	0.50	0.52			
	Residual Cl2 Combined	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Total	0.85	0.63	0.75				0.85	0.75	0.79				-	-	-			
JUL	Cl2 Demand	-	-	-				-	-	-				-	-	-			
	Cl2 Dosage	1.90	1.45	1.59				2.06	1.49	1.85				1.73	1.40	1.56			
	Ammonia	-	-	-				-	-	-				-	-	-			
	SO2	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Free	0.68	0.62	0.65				0.70	0.55	0.64				0.55	0.50	0.52			
	Residual Cl2 Combined	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Total	0.80	0.70	0.76				0.90	0.70	0.78				-	-	-			
AUG	Cl2 Demand	-	-	-				-	-	-				-	-	-			
	Cl2 Dosage	2.14	1.58	1.80				2.10	1.60	1.82				2.20	1.50	1.70			
	Ammonia	-	-	-				-	-	-				-	-	-			
	SO2	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Free	0.66	0.60	0.64				0.70	0.58	0.63				0.55	0.50	0.53			
	Residual Cl2 Combined	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Total	0.85	0.67	0.76				0.85	0.68	0.74				-	-	-			

TABLE 3.0 (cont'd)

		1986						1985						1984					
		PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION			PRE-CHLORINATION			POST-CHLORINATION		
		MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG
SEP	Cl2 Demand	-	-	-				-	-	-				-	-	-			
	Cl2 Dosage	1.94	1.63	1.68				1.89	1.48	1.75				1.57	1.30	1.45			
	Ammonia	-	-	-				-	-	-				-	-	-			
	SO2	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Free	0.76	0.55	0.65				0.65	0.55	0.62				0.55	0.50	0.52			
	Residual Cl2 Combined	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Total	0.80	0.60	0.69				0.75	0.64	0.72				-	-	-			
OCT	Cl2 Demand	-	-	-				-	-	-				-	-	-			
	Cl2 Dosage	2.10	1.65	1.79				2.37	1.54	1.70				1.70	1.20	1.46			
	Ammonia	-	-	-				-	-	-				-	-	-			
	SO2	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Free	0.70	0.62	0.64				0.65	0.56	0.62				0.55	0.50	0.51			
	Residual Cl2 Combined	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Total	0.80	0.70	0.76				0.78	0.65	0.71				-	-	-			
NOV	Cl2 Demand	-	-	-				-	-	-				-	-	-			
	Cl2 Dosage	2.17	1.34	1.79				2.24	1.70	2.00				1.70	1.34	1.51			
	Ammonia	-	-	-				-	-	-				-	-	-			
	SO2	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Free	0.69	0.61	0.64				0.65	0.58	0.62				0.55	0.50	0.55			
	Residual Cl2 Combined	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Total	0.88	0.69	0.76				0.78	0.67	0.72				-	-	-			
DEC	Cl2 Demand	-	-	-				-	-	-				-	-	-			
	Cl2 Dosage	2.10	1.64	1.90				1.87	1.50	1.69				1.51	1.33	1.40			
	Ammonia	-	-	-				-	-	-				-	-	-			
	SO2	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Free	0.99	0.62	0.81				0.69	0.58	0.62				0.55	0.50	0.55			
	Residual Cl2 Combined	-	-	-				-	-	-				-	-	-			
	Residual Cl2 Total	1.20	0.72	0.94				0.78	0.67	0.72				-	-	-			

TABLE 4.0: T&O CONTROL, ALKALINITY ADJ. & FLUORIDATION SUMMARY

MOE WPOS PROTOCOL

		1986			1985			1984			1983		
		MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG
JAN	PAC	-	-	-	-	-	-	-	-	-	-	-	-
	KMnO4	-	-	-	-	-	-	-	-	-	-	-	-
	Lime	-	-	-	-	-	-	-	-	-	-	-	-
	Soda Ash												
	F Dosage	1.15	1.02	1.09	1.10	1.03	1.07	0.84	0.72	0.79	0.81	0.70	0.76
	F Res.	1.22	1.02	1.14	1.37	1.05	1.17	1.06	0.94	0.99	1.05	0.85	0.95
FEB	PAC	-	-	-	-	-	-	-	-	-	-	-	-
	KMnO4	-	-	-	-	-	-	-	-	-	-	-	-
	Lime	-	-	-	-	-	-	-	-	-	-	-	-
	Soda Ash												
	F Dosage	1.14	1.06	1.09	1.12	1.06	1.08	0.87	0.78	0.81	0.83	0.62	0.73
	F Res.	1.25	1.16	1.20	1.30	1.10	1.19	1.05	0.92	0.99	1.10	0.90	0.98
MAR	PAC	-	-	-	-	-	-	-	-	-	-	-	-
	KMnO4	-	-	-	-	-	-	-	-	-	-	-	-
	Lime	-	-	-	-	-	-	-	-	-	-	-	-
	Soda Ash												
	F Dosage	1.14	0.65	1.07	1.12	1.05	1.08	1.03	0.78	0.82	0.97	0.57	0.83
	F Res.	1.25	1.15	1.21	1.83	1.10	1.20	1.02	0.83	0.98	1.10	0.95	1.02
APR	PAC	-	-	-	-	-	-	-	-	-	-	-	-
	KMnO4	-	-	-	-	-	-	-	-	-	-	-	-
	Lime	-	-	-	-	-	-	-	-	-	-	-	-
	Soda Ash												
	F Dosage	1.11	1.04	1.09	1.12	1.04	1.08	0.95	0.82	0.89	0.93	0.75	0.89
	F Res.	1.30	1.20	1.23	1.20	1.10	1.18	1.20	0.95	1.00	1.10	0.95	1.03
MAY	PAC	-	-	-	-	-	-	-	-	-	-	-	-
	KMnO4	-	-	-	-	-	-	-	-	-	-	-	-
	Lime	-	-	-	-	-	-	-	-	-	-	-	-
	Soda Ash												
	F Dosage	1.11	0.98	1.06	1.36	1.08	1.14	0.99	0.60	0.94	0.92	0.71	0.80
	F Res.	1.25	1.18	1.20	1.30	1.15	1.20	1.11	0.98	1.04	1.10	0.95	1.04
JUN	PAC	-	-	-	-	-	-	-	-	-	-	-	-
	KMnO4	-	-	-	-	-	-	-	-	-	-	-	-
	Lime	-	-	-	-	-	-	-	-	-	-	-	-
	Soda Ash												
	F Dosage	1.13	0.80	1.06	1.36	0.90	1.09	1.04	0.78	0.96	0.87	0.69	0.74
	F Res.	1.25	1.18	1.21	1.30	1.11	1.19	1.12	1.00	1.03	1.10	0.90	0.99

TABLE 4.0 (cont'd)

JUL	PAC	-	-	-	-	-	-	-	-	-	-	-	-
	$KMnO_4$	-	-	-	-	-	-	-	-	-	-	-	-
	Lime	-	-	-	-	-	-	-	-	-	-	-	-
	Soda Ash												
	F Dosage	1.16	1.02	1.08	1.76	0.79	1.13	1.20	0.97	1.10	-	-	-
	F Res.	1.27	1.18	1.22	1.22	1.10	1.18	1.25	1.01	1.13	-	-	-
AUG	PAC	-	-	-	-	-	-	-	-	-	-	-	-
	$KMnO_4$	-	-	-	-	-	-	-	-	-	-	-	-
	Lime	-	-	-	-	-	-	-	-	-	-	-	-
	Soda Ash												
	F Dosage	1.13	0.81	1.06	1.26	0.98	1.08	1.28	1.12	1.19	1.02	0.74	0.92
	F Res.	1.25	1.12	1.21	1.24	1.00	1.16	1.20	1.02	1.12	1.10	0.90	0.99
SEP	PAC	-	-	-	-	-	-	-	-	-	-	-	-
	$KMnO_4$	-	-	-	-	-	-	-	-	-	-	-	-
	Lime	-	-	-	-	-	-	-	-	-	-	-	-
	Soda Ash												
	F Dosage	1.14	0.94	1.02	1.12	0.90	1.07	1.16	1.04	1.11	1.20	0.58	0.91
	F Res.	1.25	1.18	1.21	1.24	1.15	1.19	1.30	1.03	1.14	1.10	0.87	0.98
OCT	PAC	-	-	-	-	-	-	-	-	-	-	-	-
	$KMnO_4$	-	-	-	-	-	-	-	-	-	-	-	-
	Lime	-	-	-	-	-	-	-	-	-	-	-	-
	Soda Ash												
	F Dosage	1.20	0.95	1.05	1.14	1.04	1.09	1.18	1.02	1.09	1.07	0.87	0.95
	F Res.	1.39	1.12	1.22	1.25	1.15	1.18	1.30	1.10	1.20	1.10	0.95	1.00
NOV	PAC	-	-	-	-	-	-	-	-	-	-	-	-
	$KMnO_4$	-	-	-	-	-	-	-	-	-	-	-	-
	Lime	-	-	-	-	-	-	-	-	-	-	-	-
	Soda Ash												
	F Dosage	1.19	0.95	1.14	1.14	1.02	1.10	1.16	1.02	1.07	0.82	0.62	0.80
	F Res.	1.25	1.15	1.20	1.20	1.06	1.15	1.32	1.14	1.19	1.00	0.80	0.94
DEC	PAC	-	-	-	-	-	-	-	-	-	-	-	-
	$KMnO_4$	-	-	-	-	-	-	-	-	-	-	-	-
	Lime	-	-	-	-	-	-	-	-	-	-	-	-
	Soda Ash												
	F Dosage	1.10	0.98	1.02	1.11	1.05	1.08	1.12	0.98	1.07	0.85	0.78	0.82
	F Res.	1.27	1.15	1.19	1.20	1.03	1.14	1.31	1.10	1.18	1.00	0.88	0.95

WPOS

PLANT NORTHBAY WATER QUALITY - 1-YEAR SUMMARY (1985)

GENERAL CHEMISTRY		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		19 ___													
GENERAL CHEMISTRY															
ALKALINITY	R	11.6	—	—	11.0	—	—	10.4	—	—	10.8	—	—	0.2	
mg/L	T	17.4	—	—	233	—	—	21.2	-	—	26.9	-	—	mg/L	
AMMONIUM TOTAL	R													0.05	
mg/L	T													mg/L	
CALCIUM	R													0.1	
mg/L	T													mg/L	
CHLORIDE	R	10.3	—	—	17.0	—	—	11.0	—	—	11.6	—	—	0.2	250
mg/L	T	10.7	—	—	18.2	—	—	10.9	—	—	11.4	—	—	mg/L	mg/L
COLOUR TCU	R	9.0	—	—	7.5	—	—	7.5	—	—	6.0	—	—	0.5	5
	T	8.0	—	—	8.5	—	—	26.5	—	—	9.0	—	—	TCU	TCU
CONDUCTIVITY	R	88.6	—	—	117.0	—	—	89.7	—	—	93.8	—	—	0.01	
umho/cm	T	105.3	—	—	145.5	—	—	108.9	—	—	118.5	—	—	UMHO/CM	
FIELD CHLORINE (COMBINED)	R													0.1	
mg/L	T													mg/L	
FIELD CHLORINE (FREE)	R													0.1	
mg/L	T													mg/L	
FIELD CHLORINE (TOTAL)	R													0.1	
mg/L	T													mg/L	
FIELD PH	R													0.2	
	T														

WPOS

PLANT NORTHBAY WATER QUALITY - 1-YEAR SUMMARY (1985)

GENERAL CHEMISTRY (Cont'd)		19 __ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
FIELD TEMPERATURE	R														
°C	T														
FIELD TURBIDITY	R														1 FTU
FTU	T														
FLUORIDE	R	—	—	—	—	—	—	—	—	—	—	—	—	0.01	2.4
mg/L	T	—	—	—	1.17	—	—	—	—	—	1.09	—	—	mg/L	mg/L
HARDNESS	R	21.0	—	—	24.6	—	—	21.6	—	—	22.0	—	—	0.5	
mg/L	T	21.9	—	—	24.2	—	—	18.6	—	—	21.5	—	—	mg/L	
MAGNESIUM	R													0.05	
mg/L	T													mg/L	c
NITRATE	R	0.25	—	—	0.45	—	—	0.50	—	—	0.40	—	—	0.05	10 mg/L
mg/L	T	0.25	—	—	0.41	—	—	0.32	—	—	0.40	—	—	mg/L	as N
NITRITE	R													0.005	1 mg/L
mg/L	T													mg/L	as N
NITROGEN TOTAL KJELDAHL	R													0.1	0.15
mg/L	T													mg/L	mg/L *
PH	R	7.11	—	—	7.11	—	—	7.18	—	—	6.65	—	—		
	T	7.66	—	—	7.54	—	—	7.76	—	—	7.50	—	—		
PHOSPHORUS FILTERED REACTIVE	R													0.01	
mg/L	T													mg/L	

WPOS

PLANT NORTHBAY WATER QUALITY - 1-YEAR SUMMARY (1985)

GENERAL CHEMISTRY (Cont'd)			19 ___												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
			JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
PHOSPHORUS TOTAL		R													0.01	
	mg/L	T													mg/L	
SODIUM		R													0.1	
	mg/L	T													mg/L	
TOTAL SOLIDS		R													1	
	mg/L	T													mg/L	
TURBIDITY		R	0.50	—	—	<0.60	—	—	<0.55	—	—	1.43	—	—	0.01	1
	FTU	T	1.00	—	—	0.74	—	—	3.05	—	—	4.00	—	—	FTU	FTU
METALS																
ALUMINUM		R	0.220	—	—	0.074	—	—	0.044	—	—	0.049	—	—	0.003	
	mg/L	T	0.018	—	—	0.021	—	—	0.059	—	—	0.438	—	—	mg/L	
ARSENIC		R													0.001	0.05
	mg/L	T													mg/L	mg/L
BARIUM		R	0.014	—	—	0.018	—	—	0.015	—	—	0.015	—	—	0.001	1
	mg/L	T	0.011	—	—	0.014	—	—	0.011	—	—	0.020	—	—	mg/L	mg/L
BERYLLIUM		R	<0.001	—	—	<0.001	—	—	<0.001	—	—	<0.001	—	—	0.001	
	mg/L	T	<0.001	—	—	<0.001	—	—	<0.001	—	—	<0.001	—	—	mg/L	
BORON		R													0.02	5
	mg/L	T													mg/L	mg/L
CADMIUM		R	<0.0002	—	—	0.0003	—	—	<0.0003	—	—	<0.0002	—	—	0.0003	0.005
	mg/L	T	<0.0002	—	—	<0.0002	—	—	<0.0003	—	—	<0.0002	—	—	mg/L	mg/L

WPOS

PLANT NORTH BAY WATER QUALITY - 1-YEAR SUMMARY (1985)

METALS (Cont'd)			19 ___ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
CHROMIUM		R	0.001	—	—	<0.001	—	—	<0.001	—	—	<0.001	—	—	0.001	0.05
	mg/L	T	<0.001	—	—	<0.001	—	—	<0.001	—	—	<0.001	—	—	mg/L	mg/L
COBALT		R	<0.001	—	—	<0.001	—	—	<0.001	—	—	<0.001	—	—	0.001	
	mg/L	T	<0.001	—	—	<0.001	—	—	0.002	—	—	<0.001	—	—	mg/L	
COPPER		R	0.004	—	—	0.004	—	—	0.003	—	—	0.021	—	—	0.001	1
	mg/L	T	0.048	—	—	0.054	—	—	0.007	—	—	0.082	—	—	mg/L	mg/L
CYANIDE		R													0.001	0.2
	mg/L	T													mg/L	mg/L
IRON		R	0.04	—	—	0.12	—	—	<0.04	—	—	0.06	—	—	0.002	0.3
	mg/L	T	0.07	—	—	0.12	—	—	0.88	—	—	0.82	—	—	mg/L	mg/L c
LEAD	mg/L	R	<0.003	—	—	<0.003	—	—	0.007	—	—	<0.003	—	—	0.003	0.05
		T	<0.003	—	—	<0.003	—	—	0.008	—	—	0.004	—	—	mg/L	mg/L
MANGANESE		R	<0.008	—	—	0.015	—	—	<0.005	—	—	0.01	—	—	0.001	0.05
	mg/L	T	0.009	—	—	0.012	—	—	0.017	—	—	0.22	—	—	mg/L	mg/L
MOLYBDENUM		R	<0.001	—	—	<0.001	—	—	<0.001	—	—	<0.001	—	—	0.001	
	mg/L	T	<0.001	—	—	<0.001	—	—	<0.001	—	—	<0.001	—	—	mg/L	
MERCURY		R													0.01	1
	ug/L	T													ug/L	ug/L
NICKEL		R	0.002	—	—	0.001	—	—	<0.002	—	—	<0.001	—	—	0.002	
	mg/L	T	0.001	—	—	0.001	—	—	0.002	—	—	0.002	—	—	mg/L	

WPOS

PLANT NORTHBAY WATER QUALITY - 1-YEAR SUMMARY (1985)

METALS (Cont'd)		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
SELENIUM	R													0.001	0.01
mg/L	T													mg/L	mg/L
STRONTIUM	R	0.041	–	–	0.045	–	–	0.044	–	–	0.048	–	–	0.001	
mg/L	T	0.041	–	–	0.043	–	–	0.034	–	–	0.046	–	–	mg/L	
TIN	R														
(no units available)	T														
URANIUM	R													0.002	.02
mg/L	T													mg/L	mg/L t
VANADIUM	R	<0.001	–	–	<0.001	–	–	<0.001	–	–	<0.001	–	–	0.001	
mg/L	T	<0.001	–	–	<0.001	–	–	<0.001	–	–	<0.001	–	–	mg/L	
ZINC	R	0.025	–	–	0.019	–	–	0.021	–	–	0.017	–	–	0.001	5
mg/L	T	0.015	–	–	0.017	–	–	0.081	–	–	0.067	–	–	mg/L	mg/L h
<u>PURGEABLES</u>															
BENZENE	R													1	10
ug/L	T													ug/L	ug/L h
BROMOFORM	R													1	350
ug/L	T													ug/L	ug/L ++
CARBON TETRACHLORIDE	R													1	3
ug/L	T													ug/L	ug/L h
CHLOROBENZENE	R													1	100-300
ug/L	T													ng/L	ng/L h*

MPOS

PLANT NORTHBAY WATER QUALITY - 1-YEAR SUMMARY (1985)

PURGEABLES (Cont'd)		19 __ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
CHLORODIBROMOMETHANE	R													1	350
ug/L	T													ug/L	ug/L ++
CHLOROFORM	R													1	350
ug/L	T													ug/L	ug/L ++
1,2-DICHLOROBENZENE	R													1	400
ug/L	T													ug/L	ug/L e
1,3-DICHLOROBENZENE	R													1	400
ug/L	T													ug/L	ug/L e
1,4-DICHLOROBENZENE	R													1	400
ug/L	T													ug/L	ug/L e
DICHLOROBROMOMETHANE	R													1	350
ug/L	T													ug/L	ug/L ++
1,1-DICHLOROETHANE	R													1	
ug/L	T													ug/L	
1,2-DICHLOROETHANE	R													1	10
ug/L	T													ug/L	ug/L h
1,1-DICHLOROETHYLENE	R													1	.3
ug/L	T													ug/L	ug/L h
T,1,2-DICHLOROETHYLENE	R													1	
ug/L	T													ug/L	

WPOS

PLANT NORTHBAY WATER QUALITY - 1-YEAR SUMMARY (1985)

PURGEABLES (Cont'd)		19 __ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	OWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
DICHLOROMETHANE ug/L	R T													5 ug/L	40 ug/L c
1,2 DICHLOROPROPANE ug/L	R T													1 ug/L	
ETHYLBENZENE ug/L	R T													1 ug/L	1400 ug/L e
ETHYLENE DIBROMIDE ug/L	R T														
M-XYLENE ug/L	R T													1 ug/L	620 ug/L c
O-XYLENE ug/L	R T													1 ug/L	620 ug/L c
P-XYLENE ug/L	R T													1 ug/L	620 ug/L c
TOLUENE ug/L	R T													1 ug/L	100 ug/L c
1,1,2,2-TETRACHLOROETHANE ug/L	R T													1 ug/L	1.7 ug/L e
TETRACHLOROETHYLENE ug/L	R T													1 ug/L	10 ug/L h

WPOS

PLANT NORTH BAY WATER QUALITY - 1-YEAR SUMMARY (1985)

PURGEABLES (Cont'd)		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		19 ___													
1,1,1-TRICHLOROETHANE	R													1	1000
ug/L	T													ug/L	ug/L c
1,1,2-TRICHLOROETHANE	R													1	6
ug/L	T													ug/L	ug/L e
TRICHLOROETHYLENE	R													1	30
ug/L	T													ug/L	ug/L h
TOTAL TRIHALOMETHANES	R													3	350
ug/L	T													ug/L	ug/L ++
TRIFLUOROCHLOROTOLUENE	R													1	
ug/L	T													ug/L	
ORGANOCHLORINES															
ALDRIN	R													1	700
ng/L	T													ng/L	ng/L **
ALPHA BHC	R													1	700
ng/L	T													ng/L	ng/L c
ALPHA CHLORDANE	R													2	700
ng/L	T													ng/L	ng/L ***
BETA BHC	R													1	300
ng/L	T													ng/L	ng/L c
DIELDRIN	R													2	700
ng/L	T													ng/L	ng/L **

PLANT NORTHBAY WATER QUALITY - 1-YEAR SUMMARY (1985)

ORGANOCHLORINES (Cont'd)		19 __												DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC		
ENDRIN	R													4	200
ng/L	T													ng/L	ng/L
GAMMA CHLORDANE	R													2	700
ng/L	T													ng/L	ng/L ***
HEPTACHLOR EPOXIDE	R													1	3000 +++
ng/L	T													ng/L	ng/L
HEPTACHLOR	R													1	3000
ng/L	T													ng/L	ng/L +++
HEXACHLOROBENZENE	R													1	10
ng/L	T													ng/L	ng/L h
HEXACHLOROBUTADIENE	R														
ug/L	T														
HEXACHLOROETHANE	R													1	19000
ng/L	T													ng/L	ng/L e
LINDANE	R													1	4000
ng/L	T													ng/L	ng/L
METHOXYCHLOR	R													5	100000
ng/L	T													ng/L	ng/L
MIREX	R													5	
ng/L	T													ng/L	

WPOS

PLANT NORTHBAY WATER QUALITY - 1-YEAR SUMMARY (1985)

ORGANOCHLORINES (Cont'd)		19 ___ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
OCTACHLOROSTYRENE	R													1	
ng/L	T													ng/L	
O,P-DDT	R													5	30000
ng/L	T													ng/L	ng/L d
OXYCHLORDANE	R													2	
ng/L	T													ng/L	
PCB TOTAL	R													20	3000
ng/L	T													ng/L	ng/L t
PENTACHLOROBENZENE	R													1	74000
ng/L	T													ng/L	ng/L e
P,P-DDD	R													5	d
ng/L	T													ng/L	
P,P-DDE	R													1	d
ng/L	T													ng/L	
P,P-DDT	R													5	d
ng/L	T													ng/L	
1,2,3,4-TETRACHLOROBENZENE	R													1	
ng/L	T													ng/L	
1,2,3,5-TETRACHLOROBENZENE	R													1	
ng/L	T													ng/L	

WPOS

PLANT NORTHBAY WATER QUALITY - 1-YEAR SUMMARY (1985)

ORGANOCHLORINES (Cont'd)		19 ___ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
1,2,4,5-TETRACHLOROBENZENE	R													1	38000
ng/L	T													ng/L	ng/L e
THIODAN I	R													2	74000
ng/L	T													ng/L	ng/L ea
THIODAN II	R													4	74000
ng/L	T													ng/L	ng/L ea
THIODAN SULPHATE	R													4	
ng/L	T													ng/L	
TOXAPHENE	R														
(no units available)	T														
1,2,3-TRICHLOROBENZENE	R													5	10000
ng/L	T													ng/L	ng/L y
1,2,4-TRICHLOROBENZENE	R													5	15000
ng/L	T													ng/L	ng/L y
1,3,5-TRICHLOROBENZENE	R													5	10000
ng/L	T													ng/L	ng/L y
2,3,6-TRICHLOROTOLUENE	R													5	
ng/L	T													ng/L	
2,4,5-TRICHLOROTOLUENE	R													5	10000
ng/L	T													ng/L	ng/L g

MPOS

PLANT NORTHBAY WATER QUALITY - 1-YEAR SUMMARY (1985)

ORGANOCHLORINES (Cont'd)		19__ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
2,6,A-TRICHLOROTOLUENE	R													5	
mg/L	T													ng/L	
TRIAZINES															
ALACHLOR	R														
ng/L	T														
AMETRINE	R													50	
ng/L	T													ng/L	
ATRATONE	R														
ng/L	T														
ATRAZINE	R													50	46000
ng/L	T													ng/L	ng/L I
BLADEX	R													100	10000
ng/L	T													ng/L	ng/L I
METOLACHLOR	R														
ng/L	T														
PROMETONE	R													50	
ng/L	T													ng/L	
PROMETRYNE	R													50	1000
ng/L	T													ng/L	ng/L I
PROPAZINE	R													50	
ng/L	T													ng/L	

WPOS

PLANT NORTHBAY WATER QUALITY - 1-YEAR SUMMARY (1985)

TRIAZINES (Cont'd)		19 __ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
SENCOR	R													100	
ng/L	T													ng/L	
SIMAZINE	R													50	10000
ng/L	T													ng/L	ng/L I
SPECIAL PESTICIDES															
2,4-D	R													100	100000
ng/L	T													ng/L	ng/L
2,4-D BUTYRIC ACID	R													200	18000
ng/L	T													ng/L	ng/L I
DICAMBA	R													100	87000
ng/L	T													ng/L	ng/L I
PENTACHLOROPHENOL	R													50	10000
ng/L	T													ng/L	ng/L h
PICLORAM	R													100	
ng/L	T													ng/L	
2,4-D PROPIONIC ACID	R													100	
ng/L	T													ng/L	
SILVEX	R													50	10000
ng/L	T													ng/L	ng/L
2,4,5-T	R													50	
ng/L	T													ng/L	

WPOS

PLANT NORTHBAY WATER QUALITY - 1-YEAR SUMMARY (1985)

SPECIAL PESTICIDES (Cont'd)		19 __ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
2,3,4,5-TETRACHLOROPHENOL	R													50	
ng/L	T													ng/L	
2,3,5,6-TETRACHLOROPHENOL	R													50	
ng/L	T													ng/L	
2,3,4-TRICHLOROPHENOL	R													100	
ng/L	T													ng/L	
2,4,5-TRICHLOROPHENOL	R													50	
ng/L	T													ng/L	
2,4,6-TRICHLOROPHENOL	R													50	10000
ng/L	T													ng/L	ng/L h
ORGANOPHOSPHOROUS PESTICIDES															
DIAZINON	R													50	14000
ng/L	T													ng/L	ng/L
DICHLOROVOS	R														
ng/L	T														
DURSBAN	R														
ng/L	T														
ETHION	R														
ng/L	T														
GUTHION	R														
ng/L	T														

WPOS

PLANT NORTHBAY WATER QUALITY - 1-YEAR SUMMARY (1985)

ORGANOPHOSPHOROUS PESTICIDES (Cont'd)		19 ___ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	OWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
MALATHION	R														
ng/L	T														
METHYLPARATHION	R													50	7000
ng/L	T													ng/L	ng/L
METHYLTRITHION	R														
ng/L	T														
MEVINPHOS	R														
ng/L	T														
PARATHION	R													50	35000
ng/L	T													ng/L	ng/L
PHORBATE	R														
ng/L	T														
RELDAN	R														
ng/L	T														
RONNEL	R														
ng/L	T														
MASS SPEC.															
DI-N-BUTYL PHTHALATE	R													0.1	34000
ug/L	T													ug/L	ug/L

WPOS

PLANT NORTH BAY WATER QUALITY - 1-YEAR SUMMARY (1985)

MASS SPEC.. (Cont'd)		19 __ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
N-DICHLOROMETHYLENE- PENTACHLOROANALINE ug/L	R													0.1 ug/L	
	T														
DIPHENYL ETHER ug/L	R													0.1 ug/L	
	T														
FLUORANTHENE ug/L	R													0.1 ug/L	
	T														
HEXACHLOROPROPENE ug/L	R													0.1 ug/L	
	T														
METHYL PHENANTHRENE ug/L	R													0.1 ug/L	
	T														
NAPHTHALENE ug/L	R													0.1 ug/L	
	T														
PENTACHLOROBUTADIENE ug/L	R													0.1 ug/L	
	T														
PENTACHLOROPROPANE ug/L	R													0.1 ug/L	
	T														
PENTACHLOROPROPENE ug/L	R													0.1 ug/L	
	T														
PYRENE ug/L	R													0.1 ug/L	
	T														

WPOS

PLANT NORTHBAY WATER QUALITY - 1-YEAR SUMMARY (1985)

MASS SPEC. (Cont'd)		19 __ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
TETRACHLORBUTANE ug/L	R T													0.1 ug/L	
TETRACHLOROBIPHENYL ug/L	R T													0.1 ug/L	
BACTERIA															
RAW WATER:															
TOTAL COLIFORM MF count/100mL	R	2.33	2.00	0	96.00	0.60	2.50	–	0.67	0	0.50	4.00	1.00		
TOTAL COLIFORM BKGD count/mL	R	–	–	–	–	–	–	–	–	–	–	–	–		
FECAL COLIFORM MF count/100mL	R	1.33	1.50	0.67	3.75	0	0	–	0	0	0	2.00	0	0	0/0.1 mL
STANDARD PLATE COUNT MF count/100mL	R	–	–	–	–	–	–	–	–	–	–	–	–	0	500
TREATED WATER:															
PRESENT/ABSENT TEST	T	A	A	P	P	A	A	–	A	P	P	A	P		
TOTAL COLIFORM BACKGROUND MF count/100mL	T	0	0	0.03	0.05	0	0	–	0	0.07	0.04	0	0.05	0	OWDO Bactl

WPOS

PLANT NORTHBAY WATER QUALITY - 1-YEAR SUMMARY (1985)

BACTERIA (Cont'd)		19 __ JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
TREATED WATER: (Cont'd)															
FECAL COLIFORM MF count/100mL	T	0	0	0	0	0	0	—	0	0	0	0	0	0	DDWO Bacti
STANDARD PLATE COUNT MF count/100mL	T	—	—	—	—	—	—	—	—	—	—	—	—		
IF PRESENT/ABSENT TEST POSITIVE:															
COLIFORM P/A	T			P	P					P	P		P		
FECAL COLIFORM P/A	T			A	A					A	A		A		
E. COLI P/A	T			—	—					—	—		—		
AROMONAS P/A	T			—	—					—	—		—		
STAPH. AUREUS P/A	T			—	—					—	—		—		

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WPOS

PLANT NORTH BAY WATER QUALITY - 4-YEAR SUMMARY (1982 - 1985)

GENERAL CHEMISTRY		1985			1984			1983			1982			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
GENERAL CHEMISTRY															
ALKALINITY	R	11.6	104	10.9	—	—	—	13.6	13.6	13.6	14.0	12.0	13.2	0.2	
mg/L	T	28.8	17.2	22.3	13.6	11.0	12.9	12.0	9.2	11.1	13.0	8.0	10.7	mg/L	
AMMONIUM TOTAL	R													0.05	
mg/L	T													mg/L	
CALCIUM	R	—	—	—	—	—	—	—	—	—	—	—	—	0.1	
mg/L	T	—	—	—	5.7	5.7	5.7	—	—	—	—	—	—	mg/L	
CHLORIDE	R	11.6	9.6	10.8	—	—	—	10.6	10.6	10.6	14.0	9.0	10.7	0.2	250
mg/L	T	18.8	10.6	12.9	12.2	10.2	11.1	11.8	11.6	11.7	16.0	10.0	11.3	mg/L	mg/L
COLOUR TCU	R	10.0	5.0	7.5	—	—	—	13.7	13.7	13.7	41.0	11.0	16.9	0.5	5
	T	73.5	6.0	13.0	8.6	6.3	7.9	9.7	7.0	8.8	17.7	2.9	9.3	TCU	TCU
CONDUCTIVITY	R	93.8	85.0	90.2	—	—	—	91.0	91.0	91.0	—	—	—	0.01	
umho/cm	T	147.0	104.5	119.0	95.0	91.0	93.3	96.1	91.4	93.3	—	—	—	UMHO/CM	
FIELD CHLORINE (COMBINED)	R													0.1	
mg/L	T													mg/L	
FIELD CHLORINE (FREE)	R													0.1	
mg/L	T													mg/L	
FIELD CHLORINE (TOTAL)	R													0.1	
mg/L	T													mg/L	
FIELD PH	R													0.2	
	T														

WPOS

PLANT NORTHBAY WATER QUALITY – 4-YEAR SUMMARY (1982 - 1985)

GENERAL CHEMISTRY (Cont'd)		1985			1984			1983			1982			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
FIELD TEMPERATURE	R														
°C	T														
FIELD TURBIDITY	R														1 FTU
FTU	T														
FLUORIDE	R	—	—	—	—	—	—	0.08	0.08	0.08	0.12	0.08	0.10	0.01	2.4
mg/L	T	1.18	1.08	1.13	1.00	1.00	1.00	0.78	0.75	0.77	1.00	0.60	0.84	mg/L	mg/L
HARDNESS	R	22.3	21.0	21.5	—	—	—	—	—	—	—	—	—	0.5	
mg/L	T	25.7	6.6	21.7	22.8	20.3	21.8	—	—	—	—	—	—	mg/L	
MAGNESIUM	R	—	—	—	—	—	—	20.3	20.3	20.3	—	—	—	0.05	
mg/L	T	—	—	—	1.37	1.37	1.37	20.3	18.2	19.4	—	—	—	mg/L	c
NITRATE	R	0.50	0.25	0.35	—	—	—	0.3	0.3	0.3	0.3	0.2	0.25	0.05	10 mg/L
mg/L	T	0.45	0.25	0.35	—	—	—	0.3	0.3	0.3	0.3	0.3	0.3	mg/L	as N
NITRITE	R	—	—	—	—	—	—	—	—	—	—	—	—	0.005	1 mg/L
mg/L	T	—	—	—	0.3	0.3	0.3	—	—	—	—	—	—	mg/L	as N
NITROGEN TOTAL KJELDAHL	R													0.1	0.15
mg/L	T													mg/L	mg/L *
PH	R	7.34	6.65	7.01	—	—	—	7.80	7.80	7.80	8.20	6.85	7.62		
	T	8.10	7.11	7.63	7.54	6.96	7.18	7.46	7.19	7.29	8.54	6.62	7.13		
PHOSPHORUS FILTERED REACTIVE	R													0.01	
mg/L	T													mg/L	

WPOS

PLANT NORTHBAY WATER QUALITY - 4-YEAR SUMMARY (1982-1985)

GENERAL CHEMISTRY (Cont'd)		1985			1984			1983			1982			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
PHOSPHORUS TOTAL	R													0.01	
mg/L	T													mg/L	
SODIUM	R	—	—	—	—	—	—	—	—	—	1.5	1.5	1.5	0.1	
mg/L	T	—	—	—	5.25	5.25	5.25	—	—	—	44.5	44.5	44.5	mg/L	
TOTAL SOLIDS	R													1	
mg/L	T													mg/L	
TURBIDITY	R	1.43	0.50	0.75	—	—	—	0.50	0.50	0.50	1.10	0.30	0.70	0.01	1
FTU	T	6.60	0.34	1.64	0.63	0.41	0.47	0.61	0.53	0.56	18.00	0.40	1.32	FTU	FTU
METALS															
ALUMINUM	R	0.220	0.044	0.132	—	—	—	—	—	—	—	—	—	0.003	
mg/L	T	0.240	0.016	0.055	—	—	—	—	—	—	—	—	—	mg/L	
ARSENIC	R	—	—	—	—	—	—	—	—	—	—	—	—	0.001	0.05
mg/L	T	—	—	—	0.007	0.007	0.007	—	—	—	—	—	—	mg/L	mg/L
BARIUM	R	0.015	0.014	0.015	—	—	—	—	—	—	—	—	—	0.001	1
mg/L	T	0.027	0.002	0.014	—	—	—	—	—	—	—	—	—	mg/L	mg/L
BERYLLIUM	R	<0.001	<0.001	<0.001	—	—	—	—	—	—	—	—	—	0.001	
mg/L	T	<0.001	<0.001	<0.001	—	—	—	—	—	—	—	—	—	mg/L	
BORON	R													0.02	5
mg/L	T													mg/L	mg/L
CADMIUM	R	<0.0003	<0.0003	<0.0003	—	—	—	—	—	—	—	—	—	0.0003	0.005
mg/L	T	<0.0003	<0.0003	<0.0003	—	—	—	—	—	—	—	—	—	mg/L	mg/L

MPOS

PLANT NORTHBOY WATER QUALITY – 4-YEAR SUMMARY (1982-1985)

METALS (Cont'd)			1985 MAX	1985 MIN	1985 AVE	1984 MAX	1984 MIN	1984 AVE	1983 MAX	1983 MIN	1983 AVE	1982 MAX	1982 MIN	1982 AVE	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
CHROMIUM	mg/L	R	0.001	<0.001	<0.001	—	—	—	—	—	—	—	—	—	0.001 mg/L	0.05 mg/L
		T	0.001	<0.001	<0.001	—	—	—	—	—	—	—	—	—		
COBALT	mg/L	R	0.001	<0.001	<0.001	—	—	—	—	—	—	—	—	—	0.001 mg/L	
		T	0.004	<0.001	<0.001	—	—	—	—	—	—	—	—	—		
COPPER	mg/L	R	0.005	0.003	0.004	—	—	—	—	—	—	0.014	0.014	0.014	0.001 mg/L	1 mg/L
		T	0.150	0.001	0.034	—	—	—	—	—	—	1.000	0.069	0.316		
CYANIDE	mg/L	R													0.001 mg/L	0.2 mg/L
		T														
IRON	mg/L	R	0.07	0.04	0.05	—	—	—	0.06	0.06	0.06	0.29	0.02	0.10	0.002 mg/L	0.3 mg/L c
		T	4.30	0.05	0.80	0.18	0.04	0.06	0.11	0.06	0.09	6.00	0.04	0.38		
LEAD	mg/L	R	0.007	<0.003	0.004	—	—	—	—	—	—	<0.003	<0.003	<0.003	0.003 mg/L	0.05 mg/L
		T	0.010	<0.003	0.005	—	—	—	—	—	—	0.460	0.004	0.140		
MANGANESE	mg/L	R	0.008	0.005	0.006	—	—	—	—	—	—	—	—	—	0.001 mg/L	0.05 mg/L
		T	0.310	0.003	0.038	—	—	—	—	—	—	—	—	—		
MOLYBDENUM	mg/L	R	<0.001	<0.001	<0.001	—	—	—	—	—	—	—	—	—	0.001 mg/L	
		T	<0.001	<0.001	<0.001	—	—	—	—	—	—	—	—	—		
MERCURY	ug/L	R													0.01 ug/L	1 ug/L
		T														
NICKEL	mg/L	R	0.002	<0.001	0.001	—	—	—	—	—	—	—	—	—	0.002 mg/L	
		T	0.004	<0.001	0.001	—	—	—	—	—	—	—	—	—		

WPOS

PLANT NORTHBAY WATER QUALITY - 4-YEAR SUMMARY (1982-1985)

METALS (Cont'd)		1985 MAX	1985 MIN	1985 AVE	1984 MAX	1984 MIN	1984 AVE	1983 MAX	1983 MIN	1983 AVE	1982 MAX	1982 MIN	1982 AVE	OWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
SELENIUM	R	—	—	—	—	—	—	—	—	—	—	—	—	0.001	0.01
mg/L	T	—	—	—	0.011	0.011	0.011	—	—	—	—	—	—	mg/L	mg/L
STRONTIUM	R	0.046	0.041	0.044	—	—	—	—	—	—	—	—	—	0.001	
mg/L	T	0.050	0.007	0.041	—	—	—	—	—	—	—	—	—	mg/L	
TIN	R														
(no units available)	T														
URANIUM	R													0.002	.02
mg/L	T													mg/L	mg/L t
VANADIUM	R	<0.001	<0.001	<0.001	—	—	—	—	—	—	—	—	—	0.001	
mg/L	T	<0.001	<0.001	<0.001	—	—	—	—	—	—	—	—	—	mg/L	
ZINC	R	0.025	0.021	0.023	—	—	—	—	—	—	0.023	0.023	0.023	0.001	5
mg/L	T	0.130	0.009	0.040	—	—	—	—	—	—	0.027	0.020	0.023	mg/L	mg/L h
PURGEABLES															
BENZENE	R													1	10
ug/L	T													ug/L	ug/L h
BROMOFORM	R													1	350
ug/L	T													ug/L	ug/L ++
CARBON TETRACHLORIDE	R													1	3
ug/L	T													ug/L	ug/L h
CHLOROBENZENE	R													1	100-300
ug/L	T													ng/L	ng/L h*

WPOS

PLANT NORTHBAY WATER QUALITY - 4-YEAR SUMMARY (1982-1985)

PURGEABLES (Cont'd)		1985 MAX	1985 MIN	1985 AVE	1984 MAX	1984 MIN	1984 AVE	1983 MAX	1983 MIN	1983 AVE	1982 MAX	1982 MIN	1982 AVE	DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
CHLORODIBROMOMETHANE	R													1	350
ug/L	T													ug/L	ug/L ++
CHLOROFORM	R													1	350
ug/L	T													ug/L	ug/L ++
1,2-DICHLOROBENZENE	R													1	400
ug/L	T													ug/L	ug/L e
1,3-DICHLOROBENZENE	R													1	400
ug/L	T													ug/L	ug/L e
1,4-DICHLOROBENZENE	R													1	400
ug/L	T													ug/L	ug/L e
DICHLOROBROMOMETHANE	R													1	350
ug/L	T													ug/L	ug/L ++
1,1-DICHLOROETHANE	R													1	
ug/L	T													ug/L	
1,2-DICHLOROETHANE	R													1	10
ug/L	T													ug/L	ug/L h
1,1-DICHLOROETHYLENE	R													1	.3
ug/L	T													ug/L	ug/L h
T,1,2-DICHLOROETHYLENE	R													1	
ug/L	T													ug/L	

WPOS

PLANT NORTHBOY WATER QUALITY - 4-YEAR SUMMARY (1982-1985)

PURGEABLES (Cont'd)		1985			1984			1983			1982			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
DICHLOROMETHANE	R													5	40
ug/L	T													ug/L	ug/L c
1,2 DICHLOROPROPANE	R													1	
ug/L	T													ug/L	
ETHYLBENZENE	R													1	1400
ug/L	T													ug/L	ug/L e
ETHYLENE DIBROMIDE	R														
ug/L	T														
M-XYLENE	R													1	620
ug/L	T													ug/L	ug/L c
O-XYLENE	R													1 ug/L	620
ug/L	T														ug/L c
P-XYLENE	R													1	620
ug/L	T													ug/L	ug/L c
TOLUENE	R													1	100
ug/L	T													ug/L	ug/L c
1,1,2,2-TETRACHLOROETHANE	R													1	1.7
ug/L	T													ug/L	ug/L e
TETRACHLOROETHYLENE	R													1	10
ug/L	T													ug/L	ug/L h

WPOS

PLANT NORTH BAY WATER QUALITY - 4-YEAR SUMMARY (1982-1985)

PURGEABLES (Cont'd)		1985			1984			1983			1982			OWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
1,1,1-TRICHLOROETHANE	R													1	1000
ug/L	T													ug/L	ug/L c
1,1,2-TRICHLOROETHANE	R													1	6
ug/L	T													ug/L	ug/L e
TRICHLOROETHYLENE	R													1	30
ug/L	T													ug/L	ug/L h
TOTAL TRIHALOMETHANES	R													3	350
ug/L	T													ug/L	ug/L **
TRIFLUOROCHLOROTOLUENE	R													1	
ug/L	T													ug/L	
ORGANOCHLORINES															
ALDRIN	R													1	700
ng/L	T													ng/L	ng/L **
ALPHA BHC	R													1	700
ng/L	T													ng/L	ng/L c
ALPHA CHLORDANE	R													2	700
ng/L	T													ng/L	ng/L ***
BETA BHC	R													1	300
ng/L	T													ng/L	ng/L c
DIELDRIN	R													2	700
ng/L	T													ng/L	ng/L **

WPOS

PLANT NORTHBAY WATER QUALITY - 4-YEAR SUMMARY (1982-1985)

ORGANOCHLORINES (Cont'd)		1985			1984			1983			1982			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
ENDRIN ng/L	R													4 ng/L	200 ng/L
	T														
GAMMA CHLORDANE ng/L	R													2 ng/L	700 ng/L ***
	T														
HEPTACHLOR EPOXIDE ng/L	R													1 ng/L	3000 ng/L +++
	T														
HEPTACHLOR ng/L	R													1 ng/L	3000 ng/L +++
	T														
HEXACHLOROBENZENE ng/L	R													1 ng/L	10 ng/L h
	T														
HEXACHLOROBUTADIENE ug/L	R														
	T														
HEXACHLOROETHANE ng/L	R													1 ng/L	19000 ng/L e
	T														
LINDANE ng/L	R													1 ng/L	4000 ng/L
	T														
METHOXYCHLOR ng/L	R													5 ng/L	100000 ng/L
	T														
MIREX ng/L	R													5 ng/L	
	T														

WPOS

PLANT NORTH BAY WATER QUALITY - 4-YEAR SUMMARY (1982 - 1985)

ORGANOCHLORINES (Cont'd)		1985			1984			1983			1982			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
OCTACHLOROSTYRENE	R													1	
ng/L	T													ng/L	
O,P-DDT	R													5	30000
ng/L	T													ng/L	ng/L d
OXYCHLORDANE	R													2	
ng/L	T													ng/L	
PCB TOTAL	R													20	3000
ng/L	T													ng/L	ng/L t
PENTACHLOROBENZENE	R													1	74000
ng/L	T													ng/L	ng/L e
P,P-DDD	R													5	d
ng/L	T													ng/L	
P,P-DDE	R													1	d
ng/L	T													ng/L	
P,P-DDT	R													5	d
ng/L	T													ng/L	
1,2,3,4-TETRACHLOROBENZENE	R													1	
ng/L	T													ng/L	
1,2,3,5-TETRACHLOROBENZENE	R													1	
ng/L	T													ng/L	

WPOS

PLANT Northbay WATER QUALITY - 4-YEAR SUMMARY (1982 - 1985)

ORGANOCHLORINES (Cont'd)		1985			1984			1983			1982			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
1,2,4,5-TETRACHLOROBENZENE	R													1	38000
ng/L	T													ng/L	ng/L e
THIODAN I	R													2	74000
ng/L	T													ng/L	ng/L ea
THIODAN II	R													4	74000
ng/L	T													ng/L	ng/L ea
THIODAN SULPHATE	R													4	
ng/L	T													ng/L	
TOXAPHENE	R														
(no units available)	T														
1,2,3-TRICHLOROBENZENE	R													5	10000
ng/L	T													ng/L	ng/L y
1,2,4-TRICHLOROBENZENE	R													5	15000
ng/L	T													ng/L	ng/L y
1,3,5-TRICHLOROBENZENE	R													5	10000
ng/L	T													ng/L	ng/L y
2,3,6-TRICHLOROTOLUENE	R													5	
ng/L	T													ng/L	
2,4,5-TRICHLOROTOLUENE	R													5	10000
ng/L	T													ng/L	ng/L g

WPOS

PLANT NORTHBAY WATER QUALITY - 4-YEAR SUMMARY (1982-1985)

ORGANOCHLORINES (Cont'd)		1985			1984			1983			1982			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
2,6,A-TRICHLOROTOLUENE mg/L	R T													5 ng/L	
TRIAZINES															
ALACHLOR ng/L	R T														
AMETRINE ng/L	R T													50 ng/L	
ATRATONE ng/L	R T														
ATRAZINE ng/L	R T													50 ng/L	46000 ng/L I
BLADEX ng/L	R T													100 ng/L	10000 ng/L I
METOLACHLOR ng/L	R T														
PROMETONE ng/L	R T													50 ng/L	
PROMETRYNE ng/L	R T													50 ng/L	1000 ng/L I
PROPAZINE ng/L	R T													50 ng/L	

WPOS

PLANT NORTHBAY WATER QUALITY - 4-YEAR SUMMARY (1982-1985)

TRIAZINES (Cont'd)		1985			1984			1983			1982			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
SENCOR	R													100	
ng/L	T													ng/L	
SIMAZINE	R													50	10000
ng/L	T													ng/L	ng/L I
SPECIAL PESTICIDES															
2,4-D	R													100	100000
ng/L	T													ng/L	ng/L
2,4-D BUTYRIC ACID	R													200	18000
ng/L	T													ng/L	ng/L I
DICAMBA	R													100	87000
ng/L	T													ng/L	ng/L I
PENTACHLOROPHENOL	R													50	10000
ng/L	T													ng/L	ng/L h
PICLORAM	R													100	
ng/L	T													ng/L	
2,4-D PROPIONIC ACID	R													100	
ng/L	T													ng/L	
SILVEX	R													50	10000
ng/L	T													ng/L	ng/L
2,4,5-T	R													50	
ng/L	T													ng/L	

WPOS

PLANT NORTH BAY WATER QUALITY - 4-YEAR SUMMARY (1982 - 1985)

SPECIAL PESTICIDES (Cont'd)		1985			1984			1983			1982			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
2,3,4,5-TETRACHLOROPHENOL ng/L	R													50 ng/L	
	T														
2,3,5,6-TETRACHLOROPHENOL ng/L	R													50 ng/L	
	T														
2,3,4-TRICHLOROPHENOL ng/L	R													100 ng/L	
	T														
2,4,5-TRICHLOROPHENOL ng/L	R													50 ng/L	
	T														
2,4,6-TRICHLOROPHENOL ng/L	R													50 ng/L	10000 ng/L h
	T														
ORGANOPHOSPHOROUS PESTICIDES															
DIAZINON ng/L	R													50 ng/L	14000 ng/L
	T														
DICHLOROVOS ng/L	R														
	T														
DURSBAN ng/L	R														
	T														
ETHION ng/L	R														
	T														
GUTHION ng/L	R														
	T														

WPOS

PLANT NORTH BAY WATER QUALITY - 4-YEAR SUMMARY (1982-1985)

ORGANOPHOSPHOROUS PESTICIDES (Cont'd)		1985			1984			1983			1982			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
MALATHION	R														
ng/L	T														
METHYLPARATHION	R													50	7000
ng/L	T													ng/L	ng/L
METHYLTRITHION	R														
ng/L	T														
MEVINPHOS	R														
ng/L	T														
PARATHION	R													50	35000
ng/L	T													ng/L	ng/L
PHORBATE	R														
ng/L	T														
RELDAN	R														
ng/L	T														
RONNEL	R														
ng/L	T														
MASS SPEC.															
DI-N-BUTYL PHTHALATE	R													0.1	34000
ug/L	T													ug/L	ug/L e

WPOS

PLANT NORTHBAY WATER QUALITY - 4-YEAR SUMMARY (1982-1985)

MASS SPEC. (Cont'd)		1985			1984			1983			1982			OWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
N-DICHLOROMETHYLENE-PENTACHLOROANALINE ug/L	R													0.1 ug/L	
	T														
DIPHENYL ETHER ug/L	R													0.1 ug/L	
	T														
FLUORANTHENE ug/L	R													0.1 ug/L	
	T														
HEXACHLOROPROPENE ug/L	R													0.1 ug/L	
	T														
METHYL PHENANTHRENE ug/L	R													0.1 ug/L	
	T														
NAPHTHALENE ug/L	R													0.1 ug/L	
	T														
PENTACHLOROBUTADIENE ug/L	R													0.1 ug/L	
	T														
PENTACHLOROPROPANE ug/L	R													0.1 ug/L	
	T														
PENTACHLOROPROPENE ug/L	R													0.1 ug/L	
	T														
PYRENE ug/L	R													0.1 ug/L	
	T														

WPOS

PLANT NORTH BAY WATER QUALITY - 4-YEAR SUMMARY (1982-1985)

MASS SPEC. (Cont'd)		1985			1984			1983			1982			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
TETRACHLORBUTANE ug/L	R T													0.1 ug/L	
TETRACHLOROBIPHENYL ug/L	R T													0.1 ug/L	
BACTERIA															
RAW WATER:															
TOTAL COLIFORM MF count/100mL	R	96.00	0	9.96	19.0	0.50	6.43	4.00	0.50	2.13	124	<2.00	7.24		
TOTAL COLIFORM BKGD count/100mL	R	—	—	—	—	—	—	—	—	—	—	—	—		
FECAL COLIFORM MF count/100mL	R	3.75	0	0.84	0.50	0	0.10	1.00	0	0.75	2.00	0	0.40	0	0/0.1 mL
STANDARD PLATE COUNT MF count/100mL	R	—	—	—	—	—	—	—	—	—	—	—	—	0	500
TREATED WATER:															
PRESENT/ABSENT TEST	T	P	A	A	P	A	A	P	A	A	P	A	A		
TOTAL COLIFORM BACKGROUND MF count/100mL	T	0.07	0	0.02	0.40	0	0.04	0.05	0	0.01	>160	0	1.42	0	OWDO Bact!

WPOS

PLANT NORTHBAY WATER QUALITY - 4-YEAR SUMMARY (1982-1985)

BACTERIA (Cont'd)		1985			1984			1983			1982			DWSP DETECTION LIMIT*	DRINKING WATER OBJ/ GUIDELINE[1]
		MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE	MAX	MIN	AVE		
TREATED WATER: (Cont'd)															
FECAL COLIFORM MF count/100mL	T	0	0	0	0	0	0	0	0	0	0	0	0	0	ODWO Bacti
STANDARD PLATE COUNT MF count/100mL	T	—	—	—	—	—	—	—	—	—	—	—	—		
IF PRESENT/ABSENT TEST POSITIVE:															
COLIFORM P/A	T	P	P	P	P	P	P	P	P	P	P	P	P		
FECAL COLIFORM P/A	T	A	A	A	A	A	A	A	A	A	A	A	A		
E. COLI P/A	T	—	—	—	—	—	—	—	—	—	—	—	—		
AROMONAS P/A	T	—	—	—	—	—	—	—	—	—	—	—	—		
STAPH. AUREUS P/A	T	—	—	—	—	—	—	—	—	—	—	—	—		

A0106A/eal

Table A - Footnotes

1 = see individual footnotes for Agency of guideline origin
c = California State Department of Health Action Level
d = OWDO for DDT (contains other isomers such as OPDDT and PPDDT)
e = USEPA ambient guideline
ea = United States Environmental Protection Agency (USEPA) ambient level for endosulfan (contains other isomers)
ep = USEPA proposed maximum contaminant level for drinking water
g = suggested Health and Welfare Canada/Ontario Ministry of the Environment guideline value
h = World Health Organization (WHO) guideline
h* = World Health Organization (WHO) Odour Threshold
mg/L = milligrams per litre, parts per million, (ppm)
ng/L = nanograms per litre, parts per trillion, (ppt)
Presence/Absence = microbiological test to indicate presence or absence of coliform bacteria
R = raw water
T = Treated Drinking Water
t = ODWO Interim maximum acceptable concentration, (IMAC)
ug/L = micrograms per litre, parts per billion, (ppb)
y = New York State (Taste and Odour) proposed drinking water guideline
++ = total Trihalomethanes
+++ = combined total: Heptachlor and Heptachlor Epoxide
* = if other than DWSP Detection Limit
** = total of Aldrin and Dieldrin
*** = Chlordane is a mixture of alpha and gamma isomers
! = Ministry of the Environment and Health and Welfare Canada, (IMAC)

TABLE 5.0: ALGAE COUNT

* No data available to complete table

MONTH	COUNT				
JAN	Max. Min. Avg. No. Tests				
FEB	Max. Min. Avg. No. Tests				
MAR	Max. Min. Avg. No. Tests				
APR	Max. Min. Avg. No. Tests				
MAY	Max. Min. Avg. No. Tests				
JUN	Max. Min. Avg. No. Tests				

TABLE 5.0 (cont'd.)

MONTH	COUNT				
JUL	Max. Min. Avg. No. Tests				
AUG	Max. Min. Avg. No. Tests				
SEP	Max. Min. Avg. No. Tests				
OCT	Max. Min. Avg. No. Tests				
NOV	Max. Min. Avg. No. Tests				
DEC	Max. Min. Avg. No. Tests				

TABLE 6.0: BACTERIOLOGICAL TESTING (NORTH BAY)

MOE WPOS PROTOCOL

		1986		1985		1984		1983	
		FECAL COLI	TOTAL COLI	FECAL COLI	TOTAL COLI	FECAL COLI	TOTAL COLI	FECAL COLI	TOTAL COLI
JAN	R	–	–	1.33	2.33	–	–	–	–
	T	0.00	0.00	0.00	0.00	0.00	0.00	–	–
FEB	R	0.00	0.00	1.50	2.00	–	–	0.00	2.00
	T	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
MAR	R	–	–	0.00	0.67	–	–	–	–
	T	–	–	0.00	0.03	0.00	0.02	–	–
APR	R	–	–	3.75	96.00	–	–	–	–
	T	–	–	0.00	0.05	0.00	0.00	–	–
MAY	R	–	–	0.00	0.60	–	–	2.00	2.00
	T	–	–	0.00	0.00	0.00	0.00	0.00	0.00
JUN	R	–	–	0.00	2.50	–	–	0.00	0.50
	T	–	–	0.00	0.00	0.00	0.00	0.00	0.00
JUL	R	–	–	–	–	–	–	1.00	4.00
	T	–	–	–	–	0.00	0.00	0.00	0.00
AUG	R	–	–	0.00	0.67	0.00	0.50	–	–
	T	–	–	0.00	0.00	0.00	0.00	0.00	0.00
SEP	R	–	–	0.00	0.00	0.00	0.50	–	–
	T	–	–	0.00	0.07	0.00	0.03	–	–
OCT	R	–	–	0.00	0.50	0.00	0.67	–	–
	T	–	–	0.00	0.04	0.00	0.00	0.00	0.00
NOV	R	6.00	0.00	2.00	4.00	0.00	12.00	–	–
	T	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00
DEC	R	3.33	5.67	0.00	1.00	0.50	19.00	–	–
	T	0.00	34.47	0.00	0.05	0.00	0.03	0.00	0.00

NOTES
1. Indicator bacteria per 100 mL of sample
2. R = Raw; T = Treated
3. Determine frequency with which tests are done
4. Compare lab and outside data if possible
5. Inbdicate frquency of testing; record monthly average

TABLE 7.0: ONTARIO DRINKING WATER OBJECTIVES
INCLUDING ALUMINUM (TREATED WATER AT PLANT)

DATE	PARAMETER	MEASURED PARAMETER	OBJECTIVE LIMIT

* No data avaiable to complete table

TABLE 7.1: ONTARIO DRINKING WATER OBJECTIVES
(DISTRIBUTION SYSTEM)

DATE	PARAMETER	MEASURED PARAMETER	OBJECTIVE LIMIT

* No data avaiable to complete table

APPENDIX B - DAILY LOG SHEET

REPORT PERIOD

8:00 a.m. ______________ to

8:00 a.m. ______________ *

SHIFT 1 ______________

SHIFT 2 ______________

SHIFT 3 ______________

* END OF DAY READINGS

MAIN PANEL READINGS

Stn. Flow ______________

Stn. Flow Totalizer ______________

Discharge Pressure ______________

Free Chlorine Residual ______________

Turbidity ______________

P.H. ______________

RESERVOIR METER PANEL

HLPs Discharge ______________

HLPs System Pressure ______________

HLPs Level ______________

HLPs Flow ______________

HLPs Totalizer ______________

CANADIAN FORCES BASE

CFB Discharge ______________

CFB Flow ______________

CFB Level ______________

CFB Totalizer ______________

FERRIS METER PANEL

Flow Totalizer ______________

Tank Level ______________

HYDRO METER PANEL

Demand ______________

Meter Reading ______________

MOTOR CONTROL PANELS

HOURS RUN TO DATE

P. #1 . . . . ______________

P. #2 . . . . ______________

P. #3 . . . . ______________

P. #4 . . . . ______________

P. #5 . . . . ______________

WELL LEVEL ______________

LAKE TEMP. ______________

STANDBY DIESEL HRS. ______________

CHEMICAL USAGE

H.F.S. Tank Weight ______________

Soda Ash Tank Level ______________

Hypo Tank Level ______________

LAKE LEVEL ______________

PUMPAGE ______________

USAGE ______________

SODA ASH - MAKE UP TANK # ____ H F S F[illegible]LING TANK # ____

Cubic Meters of Water ____ Weight After ____

Bags of Soda Ash ____ Weight Before ____

PUMP RUNNING DATA

	P. # 1	P. # 2	P. # 3	P. # 4	P. # 5
Time On					
Time Off					
Time On					
Time Off					
Time On					
Time Off					
Time On					
Time Off					

CHEMICAL TESTS

CHLORINE

Time ____ Total ____ Free ____ Pump # ____ Speed ____ % MA ____ Stroke ____

Time ____ Total ____ Free ____ Pump # ____ Speed ____ % MA ____ Stroke ____

Time ____ Total ____ Free ____ Pump # ____ Speed ____ % MA ____ Stroke ____

H F S

Time ____ Reading ____ Pump # ____ Speed ____ % MA ____ Stroke ____ %

Time ____ Reading ____ Pump # ____ Speed ____ % MA ____ Stroke ____ %

Time ____ Reading ____ Pump # ____ Speed ____ % MA ____ Stroke ____ %

SODA ASH

Time ____ PH ____ Pump # ____ Speed ____ % MA ____ Stroke ____ %

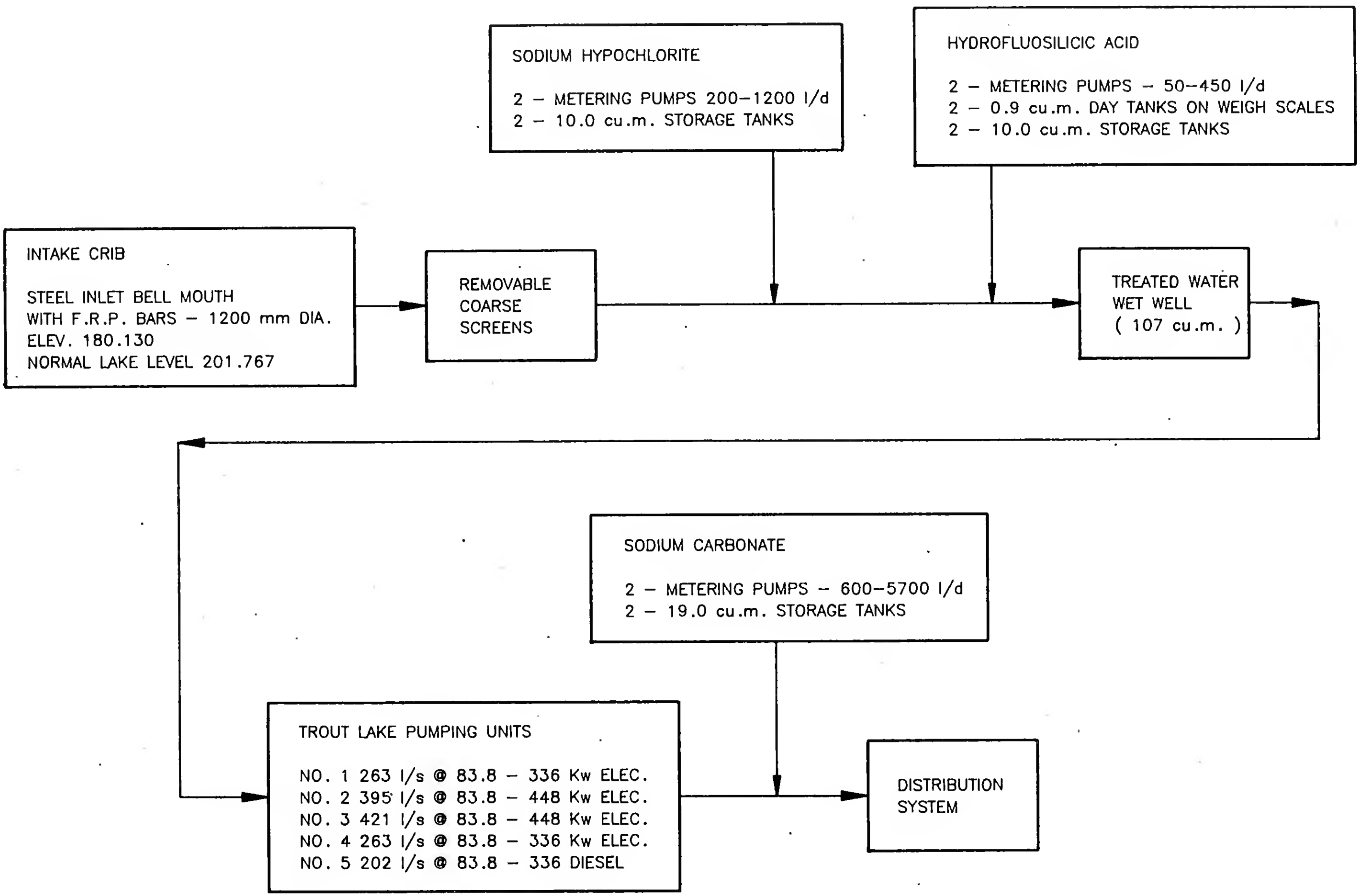
Time ____ PH ____ Pump # ____ Speed ____ % MA ____ Stroke ____ %

Time ____ PH ____ Pump # ____ Speed ____ % MA ____ Stroke ____ %

ALARMS

Time	Received / Clear	Description	Action
	/		
	/		
	/		
	/		

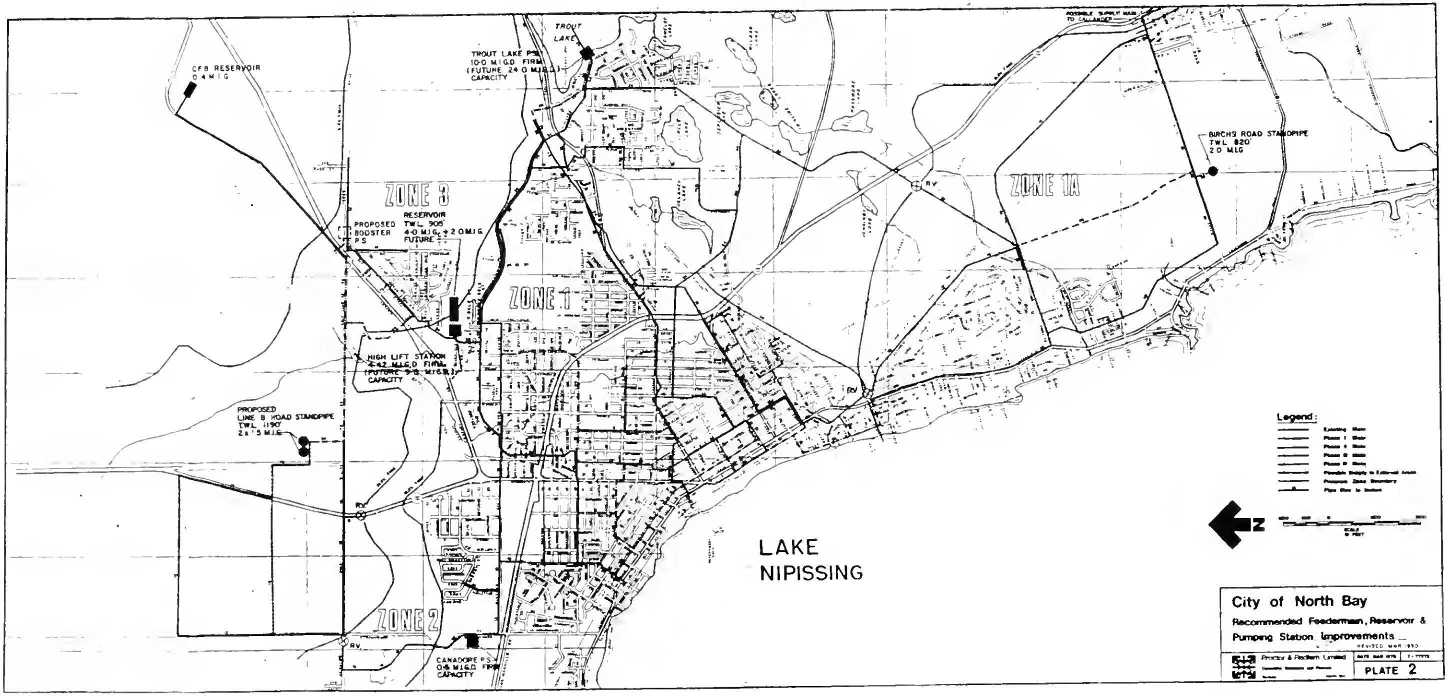
APPENDIX C - DRAWINGS



WATER PLANT OPTIMIZATION STUDY

M.O.E. PROJECT NO. 7–2042

TROUT LAKE NORTH BAY – BLOCK SCHEMATIC


CFB RESERVOIR
0.4 M.I.G.
TROUT LAKE
TROUT LAKE PS
10.0 M.I.G.D. FIRM
(FUTURE 24.0 M.I.G.D.)
CAPACITY
POSSIBLE SUPPLY MAIN TO CALLANDER
BIRCHS ROAD STANDPIPE
TWL 820'
2.0 M.I.G.
ZONE 1A
ZONE 3
PROPOSED BOOSTER P.S.
RESERVOIR
TWL 905'
4.0 M.I.G. + 2.0 M.I.G. FUTURE
ZONE 1
HIGH LIFT STATION
CAPACITY
PROPOSED
LINE B ROAD STANDPIPE
TWL 1190'
2 x 1.5 M.I.G.
ZONE 2
CANADORE P.S.
0.6 M.I.G.D. FIRM
CAPACITY
LAKE
NIPISSING
Legend:
N
City of North Bay
Recommended Feedermain, Reservoir & Pumping Station Improvements
REVISED MAR 1990
Proctor & Redfern Limited
PLATE 2

APPENDIX D - TERMS OF REFERENCE

WATER PLANT OPTIMIZATION STUDY
PLANT INVESTIGATION AND PROCESS EVALUATION STUDY
TERMS OF REFERENCE

Purpose

To review the present conditions and determine an optimum treatment strategy for contaminant removal at the plant, with emphasis on particulate materials and disinfection processes.

Work Tasks

1. Receive a package of available information on the plant from the MOE. Review the information provided and meet with the MOE staff to discuss the project.

2. Document the quality and quantity of raw and treated waters. Along with Work Task 3, send a progress report to the Project Committee at the conclusion of this work.

3. Define the present treatment processes and operating procedures. Along with Work Task 2, send a progress report to the Project Committee at the conclusion of this work.

4. Assess methods of efficient particulate removal which would utilize the present major capital works of the plant. Evaluate the particulate removal efficiency and sensitivity of operation, assuming optimum performance of the plant. Along with Work Task 5, send a progress report to the Project Committee at the conclusion of this work.

5. Assess methods which would improve, if necessary, the disinfection practices of the plant, keeping in mind a desire to minimize the production of chlorinated by-products in the treated water. Along with Work Task 4, send a progress report to the Project Committee at the conclusion of this work.

6. Describe possible short and long-term process modifications to obtain optimum disinfection and contaminant removal, with emphasis on particulate removal and a desire to minimize the production of chlorinated by-products. Meet with the Project Committee at the conclusion of this work to review the report information.

7. Prepare 7 copies of the draft report and submit to the Project Committee.

8. Review the Project Committee's comments and prepare 25 copies of the final report.

11/08/86

WATER PLANT OPTIMIZATION STUDY
PLANT INVESTIGATION AND PROCESS EVALUATION STUDY
TERMS OF REFERENCE - WORK TASK NO. 1

---

1. RECEIVE A PACKAGE OF AVAILABLE INFORMATION ON THE PLANT FROM THE MOE. REVIEW THE INFORMATION PROVIDED AND MEET WITH THE MOE STAFF TO DISCUSS THE PROJECT.

Elements of Work

(a) Receive a package of available information from the MOE concerning the plant.

(b) Review the information and otherwise prepare for a meeting to initiate work on the project, including preparation of a schedule of manpower and staff requirements.

(c) Meet with the MOE to discuss the available data, the terms of reference, and the project staff and work schedule.

2. DOCUMENT THE QUALITY AND QUANTITY OF RAW AND TREATED WATERS. ALONG WITH WORK TASK 3, SEND A PROGRESS REPORT TO THE PROJECT COMMITTEE AT THE CONCLUSION OF THIS WORK.

Elements of Work

(a) Tabulate the daily raw and treated water flows for the last three consecutive years.

(b) Document the methods of measuring the raw and treated water flow rates, and assess the validity of the records.

(c) Prepare a monthly summary of maximum, minimum, and average flows for the three years. Address any discrepancies which exist between raw and treated flow rates.

(d) Review and assess the monthly maximum, minimum, and average per capita flow for the three years. Compare the plant data with typical per capita flows for the local region.

(e) Document a summary, based on at least three years of data, of the raw and treated water quality testing data for physical, microbiological, radiological, and chemical water quality information. Document as much data as is needed to show possible seasonal trends in water quality. Where possible, show corresponding sets of raw and treated water quality information. Document the source and methods used in determining all water quality information. Assess the validity of the data, comparing plant and outside laboratory data.

(f) Tabulate, for the last three consecutive years, where available, raw and treated water turbidity, residual aluminum, pH, and colour. Record other data, such as particle counting, suspended solids, and algae counting, which could reflect on particulate removal efficiency. These data should be used for assessment of the particulate removal efficiency of the plant. Document the source and methods used in determining all information. A comparison should be made between the plant and outside laboratory information to ascertain the relative validity of the data. For plant data, emphasis should be given to plant laboratory tests rather than continuous process control instruments.

(g) Tabulate, for the last three consecutive years, the raw water bacterial test information at the plant. Also tabulate the corresponding treated water tests at the plant which register positive results. Document the source and methods used for all data provided. This information should be used to assess the effectiveness of the disinfection practices at the plant.

(h) Identify and recommend other water quality concerns, not related to particulate removal or disinfection, which should be considered as part of the assessment phase of this evaluation program.

(i) Submit a progress report to the Project Committee.

3. DEFINE THE PRESENT TREATMENT PROCESSES AND OPERATING PROCEDURES. ALONG WITH WORK TASK 2, SEND A PROGRESS REPORT TO THE PROJECT COMMITTEE AT THE CONCLUSIONS OF THIS WORK.

Elements of Work

(a) Where drawings are available, assemble sufficient record drawings, of a reduced size, to document the general site layout and the interrelationship of major plant components. If not already available, prepare a process and piping diagram (PAPD) of the plant operations.

(b) Prepare a simplified block schematic of the major plant components.

(c) Prepare a photographic record of the plant facilities, illustrating all of the major plant components and chemical feed systems.

(d) Tabulate the design parameters for all of the major plant components, with emphasis on the process operations, including chemical feeds. This information, as a minimum, must be consistent with the DWSP Questionnaire and must be confirmed and verified by field observations.

(e) Prepare a brief summary of how the plant is operated, including chemical dosage control, such as jar testing information, filter backwashing procedures and initiation, and pumping and flow control.

(f) Document and assess any reported problems in plant operations and/or in the distribution system related to water quality.

(g) Tabulate the daily average chemical dosages for the last three consecutive years. Document the methods used to evaluate chemical dosages and establish the validity of the dosage information provided.

With regard to disinfection, tabulate the dosages of chlorine and disinfection-related chemicals such as chlorine dioxide. In addition, provide corresponding data on disinfectant residuals in the plant, such as free and total chlorine residuals. Also, provide chlorine demand tests where available. Again, document the methods of dosage evaluation and residual measurements, and establish the validity of the data provided.

(h) Submit a progress report to the Project Committee.

4. ASSESS METHODS OF EFFICIENT PARTICULATE REMOVAL WHICH WOULD UTILIZE THE PRESENT MAJOR CAPITAL WORKS OF THE PLANT. EVALUATE THE PARTICULATE REMOVAL EFFICIENCY AND SENSITIVITY OF OPERATION, ASSUMING OPTIMUM PERFORMANCE OF THE PLANT. ALONG WITH WORK TASK 5, SEND A PROGRESS REPORT TO THE PROJECT COMMITTEE AT THE CONCLUSION OF THIS WORK.

Elements of Work

(a) Using information provided in Work Tasks 1 and 2, evaluate the plant's particulate removal efficiency. The basis of minimum particulate removal should be 1.0 FTU, which is the maximum acceptable concentration of the Ontario Drinking Water Objectives (Table 1, page 2, Ontario Ministry of the Environment, Revised 1983). It should, however, be recognized that it is desirable to strive for an operational level which is as low a turbidity level as is achievable.

(b) Conduct an evaluation of possible optimum performance alternatives, including jar testing of plant water samples.

(c) Evaluate the feasibility of optimum removals using the existing plant capital works. This evaluation should consider the worst case water quality conditions, even though field testing data may not be available during the initial phase of the study (see Work Task 7).

(d) Describe the operational procedures, management strategies, and equipment required for various feasible alternatives. Estimate chemical dosages, level of operational expertise, and sensitivity of operation of the alternatives.

(e) Submit a progress report to the Project Committee.

5. ASSESS METHODS WHICH WOULD IMPROVE, IF NECESSARY, THE C PRACTICES OF THE PLANT, KEEPING IN MIND A DESIRE TO MINIMIZE THE OF CHLORINATED BY-PRODUCTS IN THE TREATED WATER. ALONG WITH WOR SEND A PROGRESS REPORT TO THE PROJECT COMMITTEE AT THE CONCLUSIO WORK.

Elements of Work

(a) Using the information provided in Work Tasks 1 and 2, evaluate t: ability to disinfect the water. The basis of minimum disinfect be to ensure a water quality as described in the Ontario Drink Objectives (Ontario Ministry of the Environment, Revised 1983).

(b) Conduct an evaluation of possible optimum disinfection procedure plant, with consideration also given to the reduction of by-products in the treated water.

(c) Evaluate the feasibility of the various alternatives using the plant capital works. Estimate the initial and final levels of c by-products for the various alternatives. Assess the relative the alternatives.

(d)- Describe the operational procedures, management strategies, and required for the feasible alternatives. Estimate chemical dosag of operational expertise, and sensitivity of operation alternatives.

(e) Submit a progress report to the Project Committee.

6. DESCRIBE POSSIBLE SHORT AND LONG-TERM PROCESS MODIFICATIONS TO OBTAIN OPTIMUM DISINFECTION AND CONTAMINANT REMOVAL, WITH EMPHASIS ON PARTICULATE REMOVAL AND A DESIRE TO MINIMIZE THE PRODUCTION OF CHLORINATED BY-PRODUCTS. MEET WITH THE PROJECT COMMITTEE AT THE CONCLUSION OF THIS WORK TO REVIEW THE REPORT INFORMATION.

Elements of Work

(a) It is not the purpose of this study to provide a detailed implementation scheme for plant rehabilitation. It is, however, necessary to scope the feasible short and long-term process modifications required to achieve optimum disinfection and contaminant removals.

Prepare a list of modifications which should be considered for detailed implementation evaluation. Provide an estimated cost for each of the proposed modifications.

(b) Prepare a schedule for the list of modifications.

(c) Meet with the Project Committee at the plant site to review the proposed modifications.

7. PREPARE 7 COPIES OF THE DRAFT REPORT AND SUBMIT TO THE PROJECT COMMITTEE.

Elements of Work

(a) The report must include all the information reported previously in the study. The information must be organized and presented in a logical and co-ordinated fashion.

A general table of contents will be provided for organizing the material in a manner consistent with other plant reports.

(b) Submit the draft report to the Project Committee for review.

(c) Prepare a separate letter report containing a recommendation(s) concerning the need for additional field testing to cover water quality conditions not available during the period of this study. The Project Committee may decide to delay completion of the final report until field data can be obtained to confirm the predictions of performance for the worst case water conditions.

8. REVIEW THE PROJECT COMMITTEE'S COMMENTS AND PREPARE 25 COPIES OF THE FINAL REPORT.

Elements of Work

(a) Conduct additional field testing if required. Discuss the implications of the results with the Project Committee if the results differ from the predicted performance.

(b) Amend the report as per review comments, incorporating additional field data if required.

(c) Submit copies of the final reports to the MOE for distribution.